From Sound Effect to Sound Design: the Development of a Dramaturgical Model for Sound Design in

Rebecca – The Musical

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Submitted in partial fulfilment of the requirements of the degree of Doctor of Philosophy (by creative work and dissertation)

January, 2005

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<td>ADR</td>
<td>Automatic Dialogue Replacement</td>
</tr>
<tr>
<td>A.I.</td>
<td>Artificial Intelligence</td>
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<tr>
<td>AIFF</td>
<td>Audio Interchange File Format</td>
</tr>
<tr>
<td>Atmos.</td>
<td>Atmosphere</td>
</tr>
<tr>
<td>AU</td>
<td>Audio Units</td>
</tr>
<tr>
<td>CD-ROM</td>
<td>Compact Disc – Read Only Memory</td>
</tr>
<tr>
<td>CPU</td>
<td>Computer Central Processing Unit</td>
</tr>
<tr>
<td>DAW</td>
<td>Digital Audio Workstation</td>
</tr>
<tr>
<td>DSP</td>
<td>Digital Signal Processing</td>
</tr>
<tr>
<td>DVD</td>
<td>Digital Video Disc</td>
</tr>
<tr>
<td>GUI</td>
<td>Graphical User Interface</td>
</tr>
<tr>
<td>IAC</td>
<td>Inter-Application Communication</td>
</tr>
<tr>
<td>ICMS</td>
<td>Interactive Computer Music System</td>
</tr>
<tr>
<td>LED</td>
<td>Light-emitting Diode</td>
</tr>
<tr>
<td>MIDI</td>
<td>Musical Instrument Digital Interface</td>
</tr>
<tr>
<td>MSP</td>
<td>Max Signal Processing</td>
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<tr>
<td>POV</td>
<td>Point-of-View</td>
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<tr>
<td>QT</td>
<td>QuickTime – Apple Computer’s proprietary video file format</td>
</tr>
<tr>
<td>RAM</td>
<td>Random Access Memory</td>
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<tr>
<td>USR</td>
<td>Ultrasonic Ranging Device</td>
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This dissertation presents a notional model, as a taxonomic system, to describe dramaturgical elements of sound design in Musicals. Developed in tandem with a prototype virtual environment interface - termed ‘The MaxStage’ - and authored in the Max/MSP software, the thesis uses Rebecca - The Musical as a case study to test the efficacy of the model.

Rebecca - The Musical is in the form of a Broadway-style Musical. Consisting of two Acts, the work is an adaptation of Daphne du Maurier’s novel of the same name.

Whereas the technical art and practice of sound design for large-scale Musicals is increasingly well documented, the art form of sound design as a dramaturgical element in its own right, has received less attention. Analyses of the rôle of Sound-Designers in the theatre have tended to perpetuate the concept that sound design is commensurate with sound reinforcement. This tendency, however, delimits the creative potential of sound design to inform and elucidate the drama, as an extension of the musical score. A potentially more fluid interrelationship between music and sound design is postulated, as observed in the work of Sound-Designers for interactive computer games. As an electronic form of non-linear theatre, it is argued that new methodologies in adaptive-audio techniques, increasingly evident in computer gaming design, are relevant in defining an invigorated dramaturgy for sound design within the stage theatrical context.

The design paradigm of The MaxStage encompasses the ontologies of auditory listening theory, semiotic theories of dramatic interaction and the semantics of human–computer interface design theory. A further level of discourse pertaining to interactive computer listening and response systems for The MaxStage is theorized but not implemented.
The latter sections of the dissertation demonstrate how dramaturgical elements of sound design, as defined by the taxonomic system model, are implemented in the major creative work of the folio.

Two subsidiary orchestral pieces: *Danger Under The Moon* and *The Witchlight*, complete the creative folio. Recordings of all creative work append the respective volumes.
INTRODUCTION

The aim of this dissertation is to develop a notional model of the dramaturgy of sound design in musical theatre. Focusing on the specific functions and requirements for sound design in Musicals; alternatively referred to as ‘Broadway Musicals’ or ‘west end Musicals’, the dissertation argues that a greater interrelationship between the work of the composer and the rôle of the sound-designer would reinvigorate the sonic possibilities of the art form.

Contingent on this proposition is an acceptance that the practice of sound design for Musicals is considerably behind creative advancements made in other related fields of sound design, including film and interactive computer gaming.

Max / MSP – The MaxStage

To further investigate the validity of the proposition, a prototype application referred to throughout as, ‘The MaxStage’, was developed using Cycling 74’s Max/MSP software. The primary aim of the application is to provide a visual sound design interface to augment the creation of sound design objects not encapsulated within the composer’s score. As such, the proposed interface could be described as a ‘composer’s sound design toolbox’.

The MaxStage is the platform on which sound design objects are tested and evaluated. In itself, this toolbox does not predetermine a methodology for the design and inclusion of any subsequent auditory aura. The term ‘auditory aura’ is not used interchangeably with ‘sound design’ or ‘sonic object’. A sound

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‘The MaxStage’ application was written in version 4.06 throughout 2002-03 on an Apple G3 computer with operating system 9.1. It was continuously amended and debugged in Apple’s OSX.3.x operating system on a G4 laptop.
A greater appreciation of situated cognition and theories of collaborative learning would have assisted in the early development of The MaxStage. Facility in coding within Max/MSP over a sustained period significantly improves problem-solving and design considerations. This is particularly relevant in applications (like The MaxStage) making extensive use of encapsulated patches. Sections of the programme are identifiably less elegant than later revisions and ‘fixes’ implemented as part of an extended debugging process.
Given the restricted time constraints in actually developing a prototype application, a generic System Information Engineering model was followed (Figure 1.).

![Generic System Information Engineering Model](image1)

With more available time, a generic Prototyping Model would have been of relatively greater benefit (Figure 2.). This would be imperative when implementing interactive computer listening and response algorithms as part of the physical ‘system generative prescriptive’ in subsequent versions of The MaxStage.

![Generic Prototyping Model Allowing a Number of Iterations](image2)

Characteristics of a generic prototype modelling process for simulations might be further described by the following flow-chart (Figure 3.)
As a simulation, nonetheless, The MaxStage adequately contributes to the following principles in the design of a multimedia interactive model for dramaturgical sound design

1. The constructed virtual environment represents complex knowledge bases as well as individual constructions of unique knowledge associations.

2. The nature and perceived value of these knowledge bases are able to be mediated not only by the designer’s intent, but also by the unique associations generated by other individuals.

3. The presentation stimuli (visual, audio, text, etc.) are semantically and contextually compatible units. Segmentation of the units is meaningful and not simply display.
4. The ability to retrace and reflect through operating the system model, enacted in the interface, allows probable construction of auditory meanings neither possible nor likely outside of the environment.

5. The interface, as a working presentation of the derived taxonomic system, assists in understanding dramaturgical relationships between intention and action. This would, hypothetically, deepen with increased usage; planning processes being enhanced by continuing manipulation of the system.

As a software consideration, Max/MSP becomes unwieldy to debug when a large and discrete number of segmented patches are used. This problem becomes proportionally more evident when using extended animated graphic techniques, as is the case in The MaxStage.

**Complexity and Inter-Application Communication in The MaxStage**

The system taxonomy for The MaxStage virtual environment is theorised and described as part of a physical, interactive computer music system (ICMS). By virtue of being a computer-modelled environment, however, The MaxStage is several steps removed from the physical technologies required to re-create auditory outcomes modelled in a virtual domain.

Similarly, this version of The MaxStage was not designed to handle specific interactive auditory stimuli as part of a physical stage presentation. Nonetheless, Max/MSP is a recognised software tool for the overall control of such physical systems, and could be adapted for this purpose. Although a completely interactive version of the MaxStage is not yet developed, The MaxStage is fully functional utilising the Musical Instrument Digital Interface (MIDI) protocol.
Delimiting the complexity level in the design of The MaxStage was evaluated through previously observed working practices of several professional composers, sound designers and directors both in the USA, and in London’s (UK) west end theatre district. Within this recognised limitation, design considerations were predicated on:

- Digital synthesis programming, as possible in Max and including the real-time signal processing capabilities afforded through auditory objects available in MSP (Max Signal Processing), is not in common use by composers of Musicals.\(^5\)

- Composers are increasingly engaging with music technology tools in the processes of composition, scoring, and printing. The protocol widely used to link these processes is MIDI. A plethora of hardware and software-based MIDI synthesizers and samplers, of varying sophistication, dominate many forms of commercial music production.

Composers are also becoming increasingly conversant with non-linear timeline-based, software recording tools, such as DigiDesign’s Pro Tools™, Apple’s Logic 7 and Mark Of The Unicorn’s (MOTU) Digital Performer\(^6\). These programs are an effective management system for the complex treatment of audio information (and MIDI) recorded in real-time, and are considerably less complex to learn than Max/MSP. Created audio files are then easily transferable to either hardware or software sample playback devices and able to be triggered via MIDI\(^7\).

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\(^5\) Max/MSP is in widespread use by composers working in other genres: notably in electro-acoustic music composition, performance installation and sonic art, and as a dedicated show-control system for large-scale popular music concerts.

\(^6\) Pro-Tools is the default industry-standard digital audio workstation (DAW) for all professional music production: including studio, film and television, and radio recording. The current release of Pro Tools is version 6.7.

\(^7\) Hardware samplers: the professionally configured AKAI series of samplers, or DigiDesign’s ADAT, are commonplace in musical theatre productions for the storage and recall of sound effects. A reluctance by sound designers in support of software-based audio tools is still evident - the lack of stability of
To this end, auditory objects developed in Pro Tools, for example, that would otherwise need to be created and edited within MSP of Max, can be used in tandem with MIDI synthesis sounds in The MaxStage environment.

Sound design objects created as examples for this dissertation, as explained in Chapter Seven, are played by VSamp: a shareware, software-based sample playback program. The sound design objects are triggered in Max/MSP, as a MIDI command; this command is then sent, via the Inter-Application Communication (IAC) bus, to VSamp. The advantage of implementing overall control of the auditory aura in this way is twofold

1. The process of sound design creation, editing, file management and audio-playback remains entirely in the digital medium

And

2. Being self-contained, no further external hardware is required.

Interactivity

In the design of The MaxStage virtual environment, the level of implemented interactivity is limited to defining movements (stage-blocking) by the virtual actors.

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8 VSamp: first released in 1996, was the first sample playback software commercially available for the Apple Macintosh computer. The application was authored by Australian meteorologist and Jazz pianist, Malcolm Haylock. VSamp is a software sample player. It comprises a program for creating and playing virtual instruments and an AudioUnit (AU) plug-in for playing VSamp instruments from within an AU sequencer.

9 An IAC bus is a virtual port. An IAC bus, once named, can be used as a port argument in Max MIDI objects.
Designed auditory objects are theorised to be further manipulated by machine learning protocols - such as artificial life algorithms or neural networks, for example - as part of a physical ICMS. However, the conceptual framework and arithmetical considerations for such protocols are beyond the parameters of the current study.

The intention is that designed auditory objects, created through a variety of synthesis techniques and audio re-sampling in Pro Tools and communicated via MIDI, would not have their respective spectral morphologies intrinsically altered by a physical ICMS. As will be argued, the criteria for any sonic alteration by an ICMS should be solely determined by rules of dramatic coherency and informed by the taxonomy of the derived System Model. These criteria, furthermore, are governed by rules of Gestalt built into the design of the ICMS. Consequently, the users of The MaxStage define the nature of the sound to be implemented; the system managing the way in which the same sound will ultimately be transmitted over time.

**Technologies of Physical Sound Systems**

This dissertation does not attempt to describe or analyse the technical foundations of the sound-designer’s craft. The use of specific types of speaker arrays, mixing consoles and other peripheral devices are not pertinent to the ensuing discussion. Equally, the design and application of diegetic sound effects (i.e., a telephone ringing or sounds suggesting an imminent storm) as commonly called for in play scripts, is not considered.

**Methodology**

The dissertation begins with a discursive examination of current trends in sound design in film, interactive computer-game development and theatre. Particular emphasis is given to examining the changing processes in sound design creation
for new-generation interactive computer games with the advancement in adaptive-audio engines such as Microsoft’s ‘Direct Music Producer’: software that enables the algorithmic recombination of MIDI sequences in real time\textsuperscript{10}. Developed to overcome the overuse of static, musical gestures in non-linear gameplay, it is proposed that such an approach to sound design has comparable potential in the sound design for Musicals.

The technique of seamlessly integrating both diegetic and non-diegetic sound sources into theatre-sound design practicum is considered briefly, with an expanded discussion of this cinematically derived technique developed in Chapter Two. This technique is almost entirely absent in sound design for Musicals, whereas it is almost a \textit{sine qua non} in contemporary film-sound design practice. Chapter One concludes by considering the reasons why the development of sound design in the theatre, and Musicals in particular, has not evolved at a similar rate to its counterparts in film and interactive game design.

Chapter Two considers the auditory aesthetics of sound from several different frameworks and points-of-view. Encompassing discourses in the areas of theatre semiotics, listening perception theory, attributes of surrogacy in sound gesture, and the spatial and temporal relationships of sound in drama, the discussion serves to identify key criteria for the derivation of a system taxonomy in theatre-sound design. This system taxonomy, subsequently distilled into a generic System Model, provides the basis upon which all sound design objects in \textit{Rebecca - The Musical} are developed.

Theories on aesthetics of auditory information are able to describe the way in which space around a sound connotes a relationship with that sound; heard and felt on a narrative level, as a complex set of interconnected attributes. It is

\textsuperscript{10} Other software that works interactively in this way includes: Nintendo’s MusyX, from Factor V and Koan Pro from SSEYO (Sony). FMOD: by a company of the same name, has been used extensively by game development companies worldwide including, Blue Tongue Entertainment (VIC., Australia); creators of \textit{Polar Express}, for PlayStation 2.
inadequate to develop abstract notions of sound as auditory objects, designed to append meaning to character or action in drama, without reference to the associative fields of dramatic semiotic enquiry. It is through an appreciation of dramatic agencies of interaction that we can substantiate the need for additional auditory aura.

The process for determining the placement of suitable audio aura in Musicals is described by the following steps

1. Why is the sound required?
2. What is the function of the sound?
3. What is the nature of the sound to be designed?
4. How does the sound function in context with the narrative action?
5. Where, in the dramatic structure, is the sound to be placed (both in terms of timeline and spatial dimension)?

As a means to test the efficacy of the foregoing questions, the conceptual framework of The MaxStage is circumscribed by a theoretical framework in human-computer interface design: in itself formulated in terms of principles of dramatic interaction and narrative design. The need to develop a graphical user interface (GUI) for The MaxStage; accessible and understood by all members of the creative-team of a Musical, is predicated on the realization that communication and collaboration may be significantly constrained by variances in technological understanding if the interface design is not transparent. By establishing a correlation between agencies of interaction in drama with agencies of representation in human-computer interface design, we can distil a process for more precise and experientially informed decisions in sound design aura for Musicals. Chapter Three looks at these problems in detail, with particular reference to Brenda Laurel’s theories on the interrelationship between theatre narrative and computer game interface design.
Chapter Four examines the broad nature of interactive computer music systems and the ways in which the constructs of such systems may be potentially applied to The MaxStage virtual environment. The implications of these findings are similarly embedded into the general system taxonomy to be applied to the System Model as explained, in detail, in Chapter Six.

Sound design for Musicals requires a different aesthetic to that of performance art, sound installation, or real-time generative computer-music performance practice. This aesthetic differentiation is fundamentally one of incorporating interactivity into an ostensibly linear narrative model. Within these parameters, the discussion examines the use of fixed gestalt mechanisms as an approach to defining interactive possibilities within the set linear framework of the Musical, and in particular to Rebecca - The Musical.

The characteristics of multimodal environments, defined as extensions of augmented reality environments, are examined for their relevance to both transparent integration in the design phase and the requirement for a real-time supervision system (such as Max/MSP) to manage the modalities and timing of events in interactive environments. As an adjunct to this investigation, Rolf Gehlhaar’s work on gesture capture, via a topographical system of coordinates (SOUND = SPACE), is analysed for its appropriateness to gesture capture in both a virtual representation and, potentially, in a physical implementation of The MaxStage. The chapter concludes by suggesting possibilities for the use of adaptive-audio techniques in the general design paradigm of topographies in The MaxStage.

Chapter Five comprises a detailed explanation of the operation of The MaxStage. The discussion is preceded by a brief history of the evolution and structure of Cycling 74’s software, Max/MSP. Each of the five modules: recording (including actor movement and sensor-zone displacement), playback, timeline bar and counter, MIDI control and the QuickTime movie window are
considered separately. The discussion also includes a brief assessment of available physical sensors appropriate to the demands of theatrical contexts.

Chapter Six begins with an overview of the sound design plot for Rebecca - The Musical. It identifies four symbolic, dramatic arcs as markers for transitional points in the narrative design. These markers are shown to be useful in identifying potential locations at which extended sound design possibilities can be overlayed onto the theatrical score. In turn, the psychological and symbolic signification of the main protagonists is considered. As well as being useful contextual information, it is suggested that an evaluation of each character’s function is necessary to establish overall dramatic coherency in the design of audio aura as part of a complete sound design. Tension curves, for Act I and Act II, assist in providing a visual representation of the points of significant dramatic transition. The rise and fall of tension is shown to be a function of changes in space, heightened emotions and contradictory behaviours of characters, as opposed to the physical actions implied by the textual narrative. Having formalised all the components in a codified taxonomy for the design of auditory aura, the chapter concludes with an explanation of how the derived System Model is read. Reference is made to both the component elements of establishing an appropriate sonic object in the virtual context and how this would be implemented in a physical space as part of an ICMS.

The last chapter provides a detailed explanation of how the two sound design examples were created and derived from the System Model. A step-by-step explanation is provided of the process of audio manipulation with the designed sonic objects in Pro Tools. This is followed by an explanation of the transfer of these sounds into VSamp; ready for audio-playback within The MaxStage Environment.

A hypothetical stage blocking of the virtual actors for each sound design example is subsequently described, showing the relevant placement of the
sensor-zones that initiate the start and finish of the MIDI-triggered audio aura. This stage-blocking is identical to the visual movement of actors as stored in Scenes 1 and 2 respectively in The MaxStage application.

The methodology employed to derive a System Model, specifically for Musicals as utilising The MaxStage, can be summarised as follows:

1. Through a discursive analysis of current developments and trends in sound design for film and computer games, identify those areas in audio and sound design advancement with potential application to sound design for the theatre and Musicals.

2. Review the psychological basis of auditory aesthetics in sound design for both film and theatre.

3. Synthesize the critical issues underpinning the relationship of audio aura to the fields of theatre semiotics, listening perception theory, and audio perspective and temporality.

4. Present a framework for the design of human-computer interfaces with interleaved reference to the design characteristics of interactive computer music systems. Evaluate how this relates to the elements of dramatic presentation and narrative considerations in the theatrical context.

5. Create a hierarchical flowchart to elucidate the design process and evaluation of auditory aura.

The process can be visually summarised, as shown in Figure 4.
Collaboration as an Ideology in Theatre

Theatre is, by its very nature, a collaborative process. The exchange of creative ideas necessitates a degree of cross-fertilization of knowledge base between members of a creative team. The success of any collaboration is constrained when the expression of creative ideas becomes reliant on a specialized body of knowledge or, on a mode of expression, which presupposes a familiarity with an arcane language. The music notation of the composer and the audio
technology schematics of the sound-designer alike, pose considerable difficulties for the stage director versed in neither of these specialised forms of knowledge. Conversely, the stage director’s expression of language as a vocabulary of theatre (in all its myriad possibilities) is a form of expression that is likely to be understood in only a perfunctory manner by the composer and the sound designer. To this scenario we might add the complexities of expertise in the work of lighting and scenic designers. There are limitations, of course, to how far the cross-fertilization of a shared knowledge base may reasonably be assumed across any of these departments. The extent of this combined knowledge base between the composer, sound-designer and the stage director has specific implications on the design of a visual sound design interface.

This dissertation explores one specific way in which an enhanced synergy may operate between core members of the creative team. Just as there is an increased perceptual engagement by percipients when the shared experience of characters in a drama become interchangeable with their personal lives, so too should we strive to create a similar level of engagement in the actual creation of the work. This duality of intention should function most effectively when cast in the same medium as the drama is experienced. This medium is expressed by both visual and auditory components, where “vision is a simultaneous sense [able to] process a number of components at the same time [and]…audition is a sequential sense.”11 This basic distinction is, as John Bracewell contends, important to understand because

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Sequential processing often makes auditory conceptual imagery difficult, in that, usually, no single sound can form a complete concept and simultaneous multiple sounds are difficult to integrate. Meaning is almost always derived from the way in which a number of individual sounds are combined together through time within the context in which those sounds occur. Placement within the sequence affects meaning. Thus, the conjunction of sounds to produce a concept image requires both a very secure understanding of the meaning to be communicated and the skill to capture and apply the component sounds required to create the image.\(^\text{12}\)

Through Bracewell’s observation, the importance of establishing a meaningful collaboration between the composer and the sound designer becomes more apparent. He argues that, “the dramatic context gives the designer a basis from which to begin, whereas for the composer the process of creation is more abstract.”\(^\text{13}\) Although, this demarcation of rôle differentiation remains pervasive in the musical theatre industry, it can be alternatively argued that the act of creation by the composer need not be entirely abstract; nor the creation of auditory stimuli by the sound designer determined only by the dramatic context.

Does the score of a Musical, when treated as a single entity, form an absolute and complete sonic experience? For many composers of Musicals, the answer to this question is likely to be, ‘yes’. Contemporary composers of Musicals may also reasonably not have considered the question of expanding the sonic framework of the Musical score, unless having been previously asked to do so as a production requirement. Why then, should we consider expanding the framework of sound design in the Musical? Understanding the corollaries of current sound design practice in film and computer interactive gaming, as compared to sound design in the theatre, is pertinent in establishing a cohesive argument for exploring this question.

\(^{12}\) Bracewell 212.
\(^{13}\) Bracewell 213. Although not directly stated by Bracewell, it is inferred that the abstract creation of sound by the composer precedes any subsequent work by the sound-designer.
Film, by definition, assumes a linear narrative model. Its start and end-points are contained and fixed in time. Within this fixed timeframe, film sound design is, nonetheless, able to establish multiple points-of-view that engender meaning in characters and situations - as determined by the director and editor. Irrespective of the fact that film is a closed system, this control over POV through the manipulation of sound significantly enhances the cinematic experience for the percipient. It is not directly interactive, but assumes a temporal position - essentially dictating a uniform interactive response from the audience.

Similarly, interactive gaming which, in many respects, combines equal parts of theatre and film narrative technique, assumes a commensurate ability to establish a variable POV but is unconstrained by the fixed linearity of time in terms of narrative duration. Through the application of emergent techniques in the creation of adaptive-audio objects, meaning and emotion of characters and the world they inhabit evolve over time; dependent on the style of game-play, meaning may be temporally fixed or remain fluid. The manner in which the game player responds to the game-play determines the level and type of interactivity.

Conversely, the Musical, which may operate in either linear or non-linear form, rarely exhibits corresponding levels of interactivity or establishes the multiplicity of points-of-view central to the design of film and game narrative.\(^\text{14}\)

Admittedly, the Musical inevitably conforms to requirements of duration, but this is less restrictive than its cinematic counterpart.

Ultimately, collaboration in Musicals is envisioned not only as cooperation and new ways of looking at current practices in sound design, but also in relation to emergent technologies and the ways in which these technologies inform new ways of thinking.
CHAPTER ONE

Current Development and Trends in Sound Design

The rapidity with which film and game sound design is evolving in relation to its live theatrical counterpart makes simplified and pragmatic comparisons between these mediums difficult. Although each of these art forms is still evolving Patrick Pummill asserts “the live world is roughly a decade behind the recording world in its use of technology”. While Pummill, an experienced Broadway sound operator, is correct in his assertion, his statement can easily be misunderstood. Kai Harada, assistant to veteran Broadway sound-designer Tony Meola, identifies the problem more succinctly as one of the audience requiring greater ‘aural stimulation’. He states, “shows are louder, system designs are much more technologically complex, and more creative input is expected from the sound-designer.” In these qualified terms, Harada clarifies Pummill’s assertion by observing that the demand for greater aural stimulation takes longer to filter down into a live theatrical context.

The possibilities of interrelationships between text, animation and sound being explored through adaptive-audio design for new-generation computer games have particular resonance for future sound design in the theatre. As Whitmore explains, “adaptive-audio is a term used to describe audio and music that reacts appropriately to - and even anticipates - gameplay”; whereby the musical components are assembled by the game, as it is played. According to Whitmore, this flexibility “allows adaptive music to sync up with the game engine and become more integral to the action on screen.”

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16 Harada.
18 Whitmore.
19 Whitmore.
The correlation between theatre and this type of computer game is predicated on the fact that interactive gaming, unlike film, is designed as a form of non-linear narrative, electronic theatre.

Sound design in film is the most advanced of the three performance mediums under discussion. In the cinematic context, sound design was an unknown term prior to the 1977 release of George Lucas’ science fiction epic, *Star Wars*. The accomplishments of sound-designer and film-editor, Walter Murch, transformed the possibilities of what could be accomplished in terms of both diegetic and non-diegetic sound sources. The greatest accomplishment by Murch, however, was the integration of seamless temporal relationships created between diegetic and non-diegetic sound.

Sounds from both earlier and later in the story merge with the simultaneous sound requirements of the narrative. This technique, used with increasing subtlety by Murch in later films such as *Apocalypse Now*, emphasized the intended emotional state of actors from disparate points of view. The concurrent development in multi-channel spatialisation of sound further enhanced this technique.

This ‘sonic-borrowing’ technique is founded in the leitmotif compositional techniques of opera composers of the nineteenth-century. Equally, the currency of this type of compositional technique is pervasive in the works of many composers of contemporary Musicals. With the advent of a new type of sound-designer (the sound-scoring designer) often working in tandem with the sound reinforcement-designer (the traditional rôle of the sound-designer in theatre), a type of sound design in the theatre comparable to the work of Murch and other film sound designers is beginning to emerge.21

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21 As an example of this distinction: Jonathon Deans or Tony Meola would be regarded as sound-reinforcement sound designers; Jon Gottlieb and James LeBrecht, as sound-score designers. Robert Milburn is an accomplished sound-reinforcement and sound-score designer. Certain composers, including Michael Roth and Philip Glass have also developed sound scores for theatre productions apart from their theatre-based composition works.
Why has the development of sound design in the theatre, and Musicals in particular, not evolved at a similar rate to film and interactive gaming sound design? There are several interconnected reasons for this anomaly which can be divided into four broad categories

1. *Transference of Technologies*: problems associated with the application of audio technologies from one medium to another.

2. *Production Concept, Design and Practice*: the way in which sound and music materials are designed and conceived for linear narrative models in film and musicals; as compared to non-linear, interactive, processes and models as required for computer-based multimedia applications.

3. *Demarcation*: the rôles of creative and technical personnel in theatre production and the extent to which these roles intersect. This may include the dissemination of specialised information and systems for the reception of knowledge between key personnel (referred to as ‘the creative team’) in theatre production.

4. *Communication*: the availability of a common language and tools, to enable cross-departmental co-operation and the fluid exchange of ideas in theatre production.

**Transference of Technologies**

There are significant problems in the adaptation of audio-related technologies from recording mediums into theatrical settings

a) The emergence of new audio technologies designed specifically for the theatre. While the adaptation of new audio technologies by theatre sound-designers does occur, this situation arises most frequently as a solution to a problem not previously encountered, or where a previous solution employed for a similar problem is ineffective.
b) Unlike film-sound, live theatre-sound does not operate within a fully controlled environment. As a result, sound-designers spend considerable time and effort in the planning stage ensuring the best possible audio outcome from all required sound sources. This difficult, and ultimately time-consuming problem-solving, often militates against the application of new audio technologies in the theatre.

c) Compounding the above problem is the likelihood that sound-designers will move into a theatre, on average, only days or weeks before opening night. This time restriction further precludes any attention to enlarged possibilities for sound design. The situation is exacerbated by the fact that large seating capacity theatres can be difficult to adapt for a prescribed stage and set design. Usually employing a fixed proscenium arch, theatres designed in an era preceding the audio (and lighting) requirements of complex, large-scale sound reinforcement systems, pose substantial problems for sound and lighting-designers. It is common for theatres to require some level of physical refurbishment to enable a workable (and inevitably, imperfect) sound design solution. Tried and true solutions prevail at the expense of time to experiment within a fixed production schedule.

d) New audio technologies developed for the recording or communications mediums are not necessarily functional in their component design for use in the theatre. One example, referred to by both Meola and Pummill, concerns the state of digital radio-frequency microphones. Both agree that not only is digital RF technology too expensive to implement but that the current “digitally-based wireless microphone would [need] to be smaller, more resilient, and less likely to lose its ability to transmit when handled roughly.”

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22 Harada.
Production Design, Concept and Practice

The production of audio (sound design and music collectively) for film and game design is different. Where does the production of audio for theatre fit in the context of the previous statement? In many respects, ‘theatre’ now lies uncomfortably between both mediums.

Whereas all forms of electronic visual entertainment are derivative of the rubric of theatrical nomenclature, the producers of film and computer games have indelibly altered the visual and sonic experience for audiences through the systematic heightening of the overall sensory experience. This heightened sensory experience does pervade one type of live theatrical experience; namely the mega-spectacular pop/rock music concert. A large part of this experience, however, is more a result of pre-recorded visual and sonic elements, as epitomized in film post-production techniques, than the mainstay experience of ‘Musicals’ in the theatre. Certainly, there are Musicals produced within the last five years that have attempted to incorporate aspects of the ‘mega-spectacular’ experience. Musicals of this type have tended to be ‘compilation’ shows redolent of their popular music derivation. These types of Musical are not intrinsic to this discussion as the creative elements of their sound design are not contingent upon a musical score originally created for the theatre.

Andrew Boyd believes that “the techniques, processes, and skills involved in the creation of [audio for film and game design] are unique and not interchangeable.” Whereas this contention is consistent with current industry practice, this statement would be untrue if were to compare the creation of audio, in either medium, to the creation of audio for the theatre. There are several reasons for this

a) In film and theatre-audio, particular consideration is given to the overall balance of narrative (dialogue) and sound, whether it is music,

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sound effects, or ambient sound requirements. This is not the case in computer-games, where dialogue is commonly replaced by gameplay direction, as visual text.

b) Whereas film necessitates a linear narrative, irrespective of which direction this occurs, it is inimical to interactive gameplay, and some forms of theatre, including possible variations in the narrative order within some Musicals. The possibilities for the expansion of non-linear narrative musical elements within the contemporary Musical, akin to the processes employed in the creation of ‘adaptive music’ (or ‘adaptive-audio’) for computer-games, is an area of research to be mined.

A major criterion in understanding how the treatment of audio (whether it be in film, theatre or interactive gaming) can be rethought in either of the other two mediums, is to identify the points where ideas intersect.

Boyd also reflects that, “we simply must start thinking about the places where the industries intersect.” Where are these points of intersection that Boyd proposes we observe? If, as Boyd believes, audio techniques, processes and skills are not interchangeable - at least between film and game design - then any intersection must occur at the boundaries of these mechanisms: that is, the computer technology that facilitates audio design.

In broad terms, without reference to specific computer and audio technology products used by sound-designers within each medium, three points of intersection can be identified.

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25 There are numerous types of non-linear narrative in theatre. Martin Esslin’s title of “Theatre of the Absurd” given to works of Beckett, Pinter et al., in which dramatic form and dialogue are abandoned, is one type. Caryl Churchill’s play Top Girls (1982) is yet another. The premise of Churchill’s play is a dinner invitation to five women; historical and literary figures, all of whom have lived in previous centuries. All aspects of linear narrative are eschewed in favour of non-connected narratives.

26 The Musical, The Mystery of Edwin Drood (1987) with music and lyrics by Rupert Holmes, is a case in point.

27 Boyd.
1. Computer memory and processing speed

2. The number of audio tracks, or audio streams, available for use

3. The ability to generate simultaneously, the total number of audio sources available.

A brief comparison of how each element functions, within each medium, is shown below.

Table 1 Points of Composite Intersection in the Use of Computer Technology for Sound Design.

<table>
<thead>
<tr>
<th>Computer memory and processing speed?</th>
<th>Theatre</th>
<th>Film</th>
<th>Computer Game</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limitations on computer memory (all available RAM) and processing speed for real-time audio interfacing and playback</td>
<td>No limits on available computer memory – no real-time audio interfacing required</td>
<td>Computer memory (sound RAM availability)</td>
<td></td>
</tr>
<tr>
<td>Number of available tracks or voices?</td>
<td>Limitation on available playback channels through industry standard CADAC, J_Type, mixing consoles for live audio reinforcement and playback</td>
<td>Minimal limitations on number of audio tracks available for atmos., room tone, stingers and Foley requirements in association with all other audio sources, i.e., location audio, ADR, music tracks etc.</td>
<td>Number of playback voices restricted by the number of audio streams available, contingent upon overall RAM of the game console</td>
</tr>
<tr>
<td>Ability to present all audio sources simultaneously?</td>
<td>Possible unwanted collision of interactive sound design or extra-musical elements with dialogue and/or music</td>
<td>Totally controlled number and mix of all audio sources</td>
<td>Run-time overlapping and mix of sounds heard at any one time is difficult to control</td>
</tr>
</tbody>
</table>
The primary observation from these points of composite intersection is the similarity in limitations and restrictions on audio design for theatre and computer games, as compared to the apparent dissimilarities in audio design for film. This observation lends weight to Boyd’s contention that “it is unproductive to think of games as ‘interactive movies’.” Where many of the limitations in computer game sound design are being gradually surmounted through the emergence of adaptive-audio engines, such as Microsoft’s ‘DirectMusic’ and the development of an IXMF standard to create a common adaptive-audio language, similar strategies for evolving greater aural stimulation in theatre sound design are not as evident. Admittedly, the problems are contextually different. There appears, nonetheless, to be a widespread reluctance in the theatre to embrace any shift toward an enhanced sonic experience.

The point of intersection between theatre and film is less obvious. The hidden problem is one of being able to manage adequately, and combine successfully, the large number of individual sound sources that may be required in the production. In theatre this restriction is governed by the number of sound operators available at any one time, the amount of physical audio equipment required, and the commensurate limitations on physical space available. Automation of sequentially predetermined audio requirements in the theatre has largely alleviated this problem.

In film, the ability to mix successfully the extensive array of audio sources required is inevitably reflected in the degree of pre-planning and collaboration between the director, sound-editor, film-editor, music-editor, composer and scoring-mixer. This same condition is also true in computer game design. However, this level of collaboration is not prevalent in theatre production, and is underdeveloped in the production of Musicals.

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28 Boyd.
Demarcation

In Musicals, the rôles of the composer and sound-designer, both historically and functionally, are discrete and specialized occupations. This notwithstanding, the advancement in digital audio and music technologies have significantly narrowed the gap between the functional capacity of the sound-designer and the composer, in terms of

a) The expressive sonic possibilities available to both occupations in designing and manipulating sound and the blurring of what may be classified as ‘sound additive’; as opposed to the traditional concept of the ‘musical score’.

b) The ability of the composer and sound-designer alike to perceive and implement additional sound worlds, in addition to orchestral musicians performing on acoustic instruments.30

Ultimately, there is a considerable divergence between the pure technological considerations of the sound-designer’s responsibilities in this production genre and the dramaturgical possibilities of the sound-designer’s craft. It is in this second consideration where a convergence between the rôle of the composer and the sound-designer is possible.

The rôle, normally assigned to the sound-designer, is to develop an appropriate sound-system for the audio reinforcement and delivery of all sonic sources for performance. This function falls into three main categories

1. Sound reinforcement for the accompanying ensemble of musicians

2. Sound reinforcement for actors and singers, and in certain circumstances their auditory displacement and/or relocation relevant to the source-field

30 Whereas this has been partially possible in the use of synthesizers and samplers for over two decades in theatre pit-orchestras, the manipulation of sound at a micro-level, i.e., the inclusion of algorithmically generative or re-combinatorial musical ideas, is not a compositional practice widely employed by musical theatre composers or theatre-based sound designers.
3. Playback of required sound effects and their associated auditory displacement within the theatre, as appropriate

The rôle of the composer is to provide all the source musical material, including pianoforte/vocal reductions, orchestra arrangements and all necessary vocal and orchestral parts. Certain aspects of this work is frequently undertaken by contracted orchestrators and arrangers.

As seen, there is very little convergence between the defined rôles of sound-designer and composer. However, this is possible through the common handling of new audio technology tools. Nevertheless, the promise of closer working collaborations between composer and sound-designer in Musicals is some way off, especially in the pre-production stage of show development. This condition is not due to any lack of interest, or willingness, by composer and sound-designer to actively co-operate in the development of a show’s sound design, but a condition of the established work practice in the production of Musicals.

**Communication**

Disparate technical terms and modes of communication can impinge significantly upon the abilities of the composer and the sound-designer to communicate effectively. It is not reasonable to assume that the sound-designer will have developed musical training; nor is it reasonable to assume that the composer will have anything other than a perfunctory knowledge of audio theory. Of course, the coincidence of these skills is beneficial to creative collaborations in this genre.

The sound designer also has an ongoing production relationship with the stage director, with whom all sound design ideas are discussed. As Gareth Fry, a renowned British sound-designer suggests, “designing the sound for a show is a responsibility…and not something that a director will relinquish
unless it is someone they trust."

Ultimately, the stage director (who has overall creative production responsibility in a Musical) is likely to have neither the requisite musical training nor audio theory knowledge to engage in detailed technical discussions with either the composer or sound-designer.

Given the above scenarios, it would be beneficial to have a generic, visual sound design tool to help initiate discussion and ideas between these areas of creative responsibility. The MaxStage provides a concise representation of stage scenography onto which can be mapped pertinent sound design concepts whilst replicating (in animated form) a visual reference to the stage director’s plot. The advantage of such an approach to collaborative design is the provision of a common language tool to facilitate representation of individual ideas in a medium that can be mutually understood. The first step toward this outcome is to examine theories on auditory perception and their relationship to the semiotics of drama.

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CHAPTER TWO

The Auditory Aesthetics of Sound

Auditory Aesthetics of Theatre Sound

Bracewell, in his seminal text on sound design in the theatre, argues that ‘aesthetics’, in psychological terms, can be described as “the attempt to correlate stimuli of certain kinds with the mental states that we experience as emotion and to determine how emotional experience is transformed into meaning.” He further suggests that, “the power of sound to produce an immediate emotional response probably outweighs vision”. In respect to Musicals, the ramification of Bracewell’s assertion is twofold

1. The aesthetics of sound design in Musicals cannot be removed from the overall emotional response to the theatrical experience; and subsequently, must partly contribute to the overall intended meaning.

2. Conversely, any attempt to define meaning from the musical narrative alone is compromised, when there is a lack of correspondence with the structural relationships of auditory stimuli over time.

The issue is not whether music alone can elicit the intended emotional response in the percipient; but whether stimuli afforded through sound design can elicit a greater intrinsic response, with its ability to provide enhanced aural stimulation. As Bracewell further contends, “music used as a component of a multiple-sense art is a different matter than music in its own right as a single-sense art form.”

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32 Bracewell 197.
33 Bracewell 198.
34 Bracewell recognises that the study of the phenomenology of musical meaning is a genuine area of research. He contends, nonetheless, that any attempt to determine musical meaning is virtually insoluble.
35 Bracewell 200.
Bracewell’s views are similarly articulated in a polemic entitled, ‘The Function of the Soundscape’ by Richard K. Thomas at Purdue University.\textsuperscript{36} In addition to extolling the value in understanding the function of the soundscape to encourage the development of a “more unified production approach to emerge”\textsuperscript{37}, Thomas also summarizes previous attempts to codify the function of sound in drama in the works of Burris-Meyer, Collison and Waaser.\textsuperscript{38}

This dissertation attempts to move a step beyond Thomas’ discussion of defining the function of sound design to include a design methodology for the construction of auditory aura.

\textbf{Auditory Aesthetics of Film Sound}

The auditory aesthetics of film-sound are mediated by one condition: that sound presupposes movement. By its very nature film sound implies, as Michel Chion suggests, “a displacement or agitation, however minimal.”\textsuperscript{39} In other words, sound has a temporal dynamic that will generally follow the visual sequence, unless the sound is deliberately placed as an asynchronous object against the picture. Furthermore, the dynamic of the temporal curve is adjusted continuously to match changes in the visual stimuli. Chion does recognise that ‘fixed sound’ of artificial origin can be represented (i.e., a telephone dial tone) but that “it is rare not to hear some trace of irregularity and motion.”\textsuperscript{40}


\textsuperscript{37} Thomas 18.


\textsuperscript{40} Chion 10.
Chion proposes the following ways in which sound is temporalised in relation to associated moving images:  

- How the sound is sustained?
- How predictable the sound is as it progresses?
- Tempo
- Sound definition

Akin to Bracewell’s observations, the impact of sound design in the theatre, by rights, should observe the same laws of temporality of sound as expounded by Chion. Certainly, the percipient’s POV in a theatrical setting is ungoverned by the predetermined POV established through a fixed camera-shot. Nonetheless, the rendering of emotional intent toward an object, space or character will be reinforced, irrespective of the medium, by assiduous attention to the movement of actors (stage-blocking) in relation to the accompanying auditory stimuli; whether it be music, sound design or an interaction of both elements.

How does the music score impact on the overall design of auditory elements in a film? Roy Prendergast believes that “the ability of music [sound] to make a psychological point in a film is a subtle one, and perhaps its most valuable contribution.” Oppositely, as an example of the way in which film theoreticians disavow this notion, Prendergast cites George Bluestone who suggests, “the rendition of mental states - memory, dream, imagination - cannot be as adequately represented by film as by language.” Prendergast is sceptical of this statement, arguing music does fulfil this function better than any other element of film.

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41 Chion 14-15.
The Designed Auditory Experience

Sound evokes place, not space.\textsuperscript{44}

Peter Sellars, leading American theatre, opera, and television director believes that, “we are in a position [in theatre] to evoke simultaneous layers of experience: flashbacks, premonitions, visitations, inner voices, the mind wandering or becoming suddenly, unbearably concentrated.”\textsuperscript{45} Underlying this viewpoint is the recognition that sound design is an auditory experience where sound is not an isolated event, but an interaction of auditory stimuli that together constitute an entire aural imagination.

In sound design, all auditory stimuli should act to punctuate moments of discovery that precipitate an emotional response, leading to some level of insight that, ultimately, invests meaning. In Musicals, this intent is predominantly a function of the interrelationship between the musical score and the textual narrative. When additional auditory stimuli reinforce this process, perception of an auditory cue by the percipient behaves as an incisive emotional trigger. Concomitantly, as Kaye and LeBrecht state, “the intent behind a cue, then, has a bearing on how you choose to execute it.”\textsuperscript{46}

Assuming the psychological intent of a chosen auditory stimulus is an abstract expression (and quite possibly an exaggeration) of a performer’s viewpoint of reality (or state of mind), a similar level of abstraction may be invoked in the design of the auditory cue without its intention becoming completely disguised. The consequences of auditory abstraction in sound design, in terms of the hierarchical structure of perceptual listening and reception modes, are discussed in the section below on listening perception theory.

\textsuperscript{44} Peter Sellars, preface, \textit{Sound and Music for the Theatre: The Art and Technique of Design} by Deena Kaye and James LeBrecht (Boston, MA: Focal Press, 1999) ix.
\textsuperscript{45} Deena Kaye and James LeBrecht \textit{x}.
\textsuperscript{46} Deena Kaye and James LeBrecht 13.
Bracewell refers to specific auditory stimuli as ‘marker events’: these being, “the significant data…to articulate the time corridor into units of experience, ordered through derivation of meaning into a hierarchy of importance.”

He believes that these dramatic marker events are always a different auditory experience than occur in everyday life. If we accept Bracewell’s contention, the concept of auditory stimuli conceived merely as sonic events simulating a realistic auditory experience, is insufficient as the basis of a successful sound design.

In one respect, this is an apparently damning indictment on the over-reliance on sound effects in the theatre, which masquerade as sound design. Bracewell’s argument, furthermore, raises questions about the validity of approaches in theatre sound design where “inadequate engagement with the medium [leads to] failed artistic insight.” This inadequacy is a result of paying too little attention to the possibilities of emotional response by the percipient, in relation to “his or her personal symbolic architecture of reality.” In Musicals, as previously identified, this ‘symbolic architecture of reality’ is the musical score, book and lyrics. Therefore, the objective of any auditory design which attempts to reconstruct, or replicate, a sound world of only causal listening associations is ultimately flawed. Insightful auditory design will result where discovery, analysis and rendering of the fluctuating emotional states of characters (as perceived by the percipient) becomes an element intrinsic to the symbolic architecture.

Any auditory stimulus designed to elicit an emotional response must be triggered by a causal relationship with the character’s perception of the imaginary world in which they move; their emotional or mental state, response to another character’s state of mind (real or inferred), memory, premonition or flashback. To be successful, the combined and ordered hierarchical auditory stimuli must be commensurate with the emotional state of the musical score over time. With this in mind, no auditory stimuli can

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47 Bracewell 201.
48 Bracewell 205.
49 Bracewell 203.
compete with the intelligibility of the spoken word. Maintaining the clarity of dialogue remains an inviolate rule in all forms of theatre.

Within these parameters, it can be argued that sound design in the theatre would benefit from a much closer relationship to the components of the musical narrative than adopted previously. As Bracewell concludes, “sound can now serve in theatre as it does in film, as a means to shape and lead emotional response, a rôle that theatre has yet to explore fully.” The relevance of this statement remains undiminished.

Understanding the Designed Auditory Experience – Theories of Discourse

The design of an enriched auditory experience for a large-scale Musical necessitates the design of a hierarchical system to codify and explicate the use of auditory stimuli that are separate from the composer’s musical score. Treated in isolation, without reference to an overarching structural paradigm, any sound design risks becoming a concatenation of unrelated auditory events.

How do we determine a frame of reference in the design of such a taxonomical system? The essential criterion is that the frame of reference has a direct relationship with the fundamental devices in the creation of theatre. Aristotle defined the poetics of mimesis (artistic representation) into six discrete functions: action, character, thought, language, melody (or pattern) and spectacle (enactment). Although Aristotle’s poetics of mimesis have been extensively re-classified and extended by theatre semioticians in the twentieth-century, the classification of all sign systems remain derivative of Aristotle’s definition.

50 Bracewell 201.
52 For example, the taxonomy of Polish semiotician, Tadeusz Kowzan, highlighted the centrality of the actor alone to thirteen systems. Further taxonomies, including Martin Esslin’s contentious linear classification, increase Kowzan’s thirteen sign-systems to twenty-two and offers a further ten which
The auditory corollary for each of these six functions has to be identified so that sonic representations may be mapped onto any aspect of the theatrical design as required. Negating this process in the sound design planning stage will result, at best, in an experiential outcome disconnected from the seminal auditory experience envisaged.

Theatre, like film, has its own form of codifying mimesis. These representational codes may be either directive (signs) or objective (signifiers). Understood in semiotic terms, it is possible to elucidate meaning for the percipient on any number of interconnected levels whether they be visual or auditory.

**Semiotics of Theatre**

The trend in communication is now towards immersion rather than detachment, towards the interactive and the participatory rather than towards solitary enjoyments, towards ever-changing dynamic experiences rather than towards the fixing of meanings as objects to be collected. Even though sound is at present still very much undervalued and underused in the new media […] there is every chance that it will have a much increased role to play in the very near future.  

In any attempt to understand the auditory aesthetic consequences when speech, music, and sound design combine to form an interaction in Musicals, we are confronted with several difficulties: namely the acculturative differences in semiotic language as used by theorists in music and drama. As Theo van Leeuwin observes, “these three [speech, music and other sounds] have usually been treated as separate, in theory as well as in practice.”

The approach of theatre semioticians including Martin Esslin, Elaine Aston and George Savona, Marvin Carlson, Peter Mudford and Susan Bassnett-McGuire have at least identified certain corollaries between speech and

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extend to cinematic media alone. For a detailed explanation of semiotic classification of mimesis and its history, see: Elaine Aston and George Savona, *Theatre As Sign System* (London: Routledge, 1991) 5-9 and 105-08.


54 van Leeuwen 1.
Similarly, the writings of music semioticians including Neil Brand, Naomi Cumming, Jean-Jacques Nattiez, Leo Treitler and Kendall Walton exhibit an appreciation of the congruence between music and speech.

With the exception of the work of Brenda Laurel, whose theory on the contiguous relationship between Aristotelian poetics of drama and the design of the computer game interface argues for the validity of such an interconnected approach, there are insufficient studies on the interconnectivity between auditory design and theatre semiotics. Nonetheless, certain connections between the semiotics of theatre and auditory design can be drawn from the electroacoustic music listening theories of Denis Smalley, Barry Truax and Ambrose Field as will be seen. The neologisms used in these theories of discourse, however, make direct comparison to theatre semiotic language, at times, difficult.

Ultimately, as Esslin remarks

Semiotics provides a most valuable method for a better understanding of the way dramatic performance creates its mimesis of human interaction through setting before its audience a duplicate, mimetic, illusionary image of the world in all its complexity.

For further information on theatre semiotics, in general, see:
Marvin Carlson, Theatre Semiotics: Sign of Life (Bloomington: Indiana University Press, 1990);
Peter Mudford, Making Theatre: From Text To Performance (New Jersey: Athlone Press, 2000);
56 For further information on the theories of musical semiotics, in general, see:
Neil Brand, Foregrounding Music in the Dramatic Experience (Luton: University of Luton Press, 1998);
Naomi Cumming, The Sonic Self. Musical Subjectivity and Signification (Bloomington: Indiana University Press, 2000);
Aston and Savona concur with Esslin believing that the usefulness of semiotic theory lies in its potential to make us more aware of how drama and theatre are made.  

**Semiotics of Performance**

The performance of a theatrical work, whatever its derivation, is by nature polysemic. It draws upon a set of sign systems, which, according to Aston and Savona, “do not operate in a linear mode (as suggested by Esslin) but in a complex and simultaneously operating network unfolding in time and space.” Correspondingly, auditory stimuli as part of a sound design may also unfold in a non-linear temporal fashion. In order to do so, auditory ‘signs’ need to be “hierarchised in such a way to help ‘fix’ meaning.”

Codification of signs according to Keir Elam is divided into *theatrical* codes and *dramatic* codes, where the word code is understood to mean “an ensemble of *correlation* rules governing the formation of sign-relationships.” Two of these codes are pertinent to audio signs: *proxemics* (codes of governing the use of space) and *kinesics* (codes governing movement). Hence, the manner in which auditory signs interact with the performer within a predetermined space, have a bearing on the overall meaning attributed to the conveyance of all interconnected and simultaneous signs.

Equally, kinesics: the ability to analyse and codify the performer’s gestures and movements has an impact on the way auditory signs are designed. Changes in gesture or in movement by the performer within an auditory space should reflect changes in the audio outcome of the sound design. This correlation between movement and auditory device is difficult to articulate,

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58 Aston and Savona 5.
59 Aston and Savona 99.
60 Aston and Savona 101.
62 Elam 50.
but in modern theatre is a function of actor ‘motivation’ - a dramaturgical philosophy initially espoused by Henrik Ibsen and Konstantin Stanislavsky. This type of actor delivery has a significant impact on sound design, when a designed auditory outcome is reliant upon a perceived change of actor-based gesture or movement. Correspondingly, the auditory sign should be an expression of the emotion motivated by the dramatic narrative as evidenced by the delineated actor movement or gesture.

From the percipient’s perspective, proxemic and kinesic codes (as auditory signs) are perceived in one of the following three ways:

1. Conventional appearance within the dramatic narrative timeline (sound effects).

2. To cultivate an illusion of time and space being altered, thereby appearing to break up a strict linear narrative (invariably non-diegetic sound).

3. To reinforce, or distance (distort), the validity of the apparent meaning as suggested by the immediate narrative text and actor movement.

Sound effects are the most conventional auditory stimuli in a theatre production. Aesthetic function is engendered by how well the audio perspective of each sound’s intent is handled within the narrative flow. This is predominantly a function of the sound’s volume and correct temporal displacement. Handling sound effects successfully in a theatre production is the least problematic aspect of any complex sound design.

A characteristic of dramatic openings, in which the gradual and partial exposition of anxieties and problems are revealed, is a good example of how the illusionary perspectives of time and space operate. So too, this enigmatic mode affords a rich source of potential audio design possibilities. In the

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dramatic exposition where “past events [are reported] with events in the ‘actual’ dramatic world which we are shown,” auditory design can encapsulate suggestions of memory (flashback), portend disaster or elucidate emotional states.

Distorting the apparent meaning of the drama is an aesthetic device frequently employed in film-music. Theatre production makes significantly less use of this device. Playing ‘against’ the action poses problems in the theatre context, unaided by a specific POV provided by ‘fixed’ camera shots. Nonetheless, it is possible in the theatre production by fixing attention onto an individual whose importance is defined through the information they have to impart and which is separate from the narrative delivery of the main protagonists. The use of ‘servant’ characters or archetypal ‘Greek Chorus’ members of the cast, are common examples of how this device is managed. Again, auditory design can encapsulate these moments with reference to ‘associative’ sounds that oppose the prevailing motivation. In Musicals, this predominantly requires the sound design to play ‘against’ the associative meanings implied by the musical score.

In whatever way auditory design contributes to the semiotic values of performance, its contribution should not merely be one of creating atmosphere but also, as Esslin suggests, of “giving form to the temporal structure of the play.” At the very least, providing a density of interweaving audio strands (as coherent ‘signifiers’) will propel the dramatic narrative forward.

**Listening Perception Theory**

The framework for all theoretical discourses on listening perception is essentially derived from the philosophies of Pierre Schaffer. As Luke Windsor suggests, we can adopt what Pierre Schaeffer devised as an idexical mode of listening; namely the difference between identifying the events that

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64 Aston and Savona 25.
65 Esslin 119.
are responsible for the emission of sound, termed ‘écouter’ and "listening as a symbolic mode, to do with sounds as signs, the relationship of sounds as signifiers to signifieds that are extra-sonores," termed ‘comprendre’.⁶⁶

Windsor argues, that in order to achieve a concatenation of circumstances between composed musical intention and the perceived auditory interpretation of those circumstances by the percipient, it is a priority to "break through the ‘acousmatic’ screen in order to ascribe causation to sounds."⁶⁷ ‘Acousmatic’ music is “all music which is presented for which we are unable to see the sources of the constituent sounds.”⁶⁸ Windsor further argues that the structural relationships can be discerned between "diffused acoustic structures"⁶⁹ but their difference should not “obscure the importance of event perception,"⁷⁰ as has been previously noted.

Windsor also contends, that “event perception more often dominates more abstract structures.”⁷¹ From this we may interpret that it is not important whether an auditory stimulus is consciously perceived, or felt as a subliminal gesture. Implicit within this statement however, is that event perception will be compromised if non-veridical associative relationships are superimposed onto the structural relationships of drama; for example, mixing non-relational signs (in semiotic terms). Windsor’s proposition suggests that where an incursion of auditory signifiers is prevalent to the point of saturation, it takes on a semiotic signification requiring further analysis by the percipient.

Whereas there is no certainty as to receptive outcome, in terms of the auditory stimuli presented, the acousmatic experience “creates a highly contingent listening context in which both composers and listeners are

⁶⁷ Windsor 9.
⁶⁸ Windsor 7.
⁶⁹ Windsor 18.
⁷⁰ Windsor 18.
⁷¹ Windsor 18.
simultaneously forced into attending to auditory structures.” In certain respects, this also negates any need to define ‘truth’ in the phenomenological sense.

**Sonic Objects and Their Rhetorical Codes**

Ambrose Field argues that a discourse is needed to encompass the use of real-world sounds that includes the possibility not only for timbral manipulation but also extra-musical signification. Through semiotic analysis of electroacoustic music, he argues that a distinction can be drawn between extra-musical interpretation and musical function. This is possible, as Field suggests, because “the signifier and signified are separate entities.” As an example, he posits that the underlying timbral progress of a work may encapsulate the signifier of the sound, “whilst the surface structure could be concerned with communicating the signified meanings denoted by that sound.” Therefore, it would appear possible, through semiotic analysis, to determine appropriate auditory stimuli for both rôles and relationships within a Musical by the use of electroacoustic materials (acting as the signifier) and the notated score and orchestrations (acting as the signified).

Field defines a ‘sonic metaphor’ as a sound with a clear extra-musical context that can suggest a musical function or process. Developing a sonic metaphor is reliant upon establishing a clear indicative ‘field’ prior to a sonic object being used such that any sense of intrusion in the overall narrative context is minimised. Significantly, Field identifies that “the timescale on which a sonic metaphor operates is important, with a requirement for events within the immediate temporal context of the metaphor to possess consistent contextual information.” Although Field is directly referring to the use of real-world sounds, sounds from any other source (including electronically created or manipulated sounds) are permissible. Furthermore, there is no reason why sonic metaphors cannot co-exist in a Musical as a function of

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72 Windsor 31.
74 Field 41-42.
75 Field 47.
sound design; used conjunctively as a means to connect both material devised by the composer (the musical score) and auditory stimuli advanced by the sound-designer. Field reinforces this idea by suggesting, “as sonic metaphors often result from listeners expecting a perceived link between two associated contexts, they could be employed by composers and sound-designers [my italics] wishing to steer their audience between different methods of perceiving their piece.”

Field’s concept of the sonic simile is a sound given new meaning by “juxtaposing it with new material.” As such, the sonic simile becomes a “powerful compositional process that can be used to add a recognisable context to abstract material.” He argues that for a sonic simile to work, the audience must be invited to make a comparison between two contexts. This is usually effected by transforming one environment into another, typically by means of an interpolative transformation where the first is progressively replaced by the second.

This concept is similar to the use of ‘transition’ music as required in adaptive-audio processes of interactive computer-game sound design. In a Musical, this concept of ‘interpolative transformation’ could be effective as a transitional state between a set musical number and the ensuing continuation of dialogue. The audio design then acts as a continuum, as suggested by Windsor, establishing a bridge connecting the two different realities of speech and music. As such, it has the potential to minimize problems often encountered in transitional movement from one form of narrative delivery (song) to another (spoken word).

‘Sonic hyperbole’ and ‘sonic personification’ are less useful as rhetorical codes within the context of sound design. As exaggerations or personal connotation, they tend toward either parody or a highly personalised point of view respectively. An example of the former would be a cartoon sound...

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76 Field 48.  
77 Field 48.  
78 Field 48.  
79 Field 49.
effect; and in the latter, a sound that has meaning only to the person who created it. ‘Sonic synedooe’ is potentially useful where only a partial aural cue is provided as an auditory reminder within a known context.

From Codes to the Listening Imagination: The Listening Fields

Denis Smalley and Michel Chion have separately re-evaluated Pierre Schaeffer’s indexical modes of listening taking into account the advancements in computer technology since the 1960s. Schaeffer’s four modes of listening are

1. Information-gathering: the provenance of the sound and the ‘message’ it carries. Messages interpreted from the spectro-morphology\(^{80}\) of the sound based on accumulated knowledge of people, situations and environment. In this mode, as Smalley states, “sounds are an index to a network of associations and experiences; we are concerned with causality.”\(^{81}\) Chion, also incorporates the notion of being aware of the sound in order to “gather information about its cause (or source).”\(^{82}\)

2. Passive reception: the provenance of the sound only where no further initiation of thought process follows. This mode entails “selective impact (my reaction to the sound).”\(^{83}\)

3. Appreciating and responding to attributes of sound: selective perusal - the intentional process of response to sounds selected on “certain spectro-morphological criteria, which appear to the listener to be more attractive, interesting or significant than others.”\(^{84}\)

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\(^{81}\) Smalley, \textit{Computer Music in Context} 79.

\(^{82}\) Chion 25.

\(^{83}\) Smalley 79.

\(^{84}\) Smalley 79.
4. Acquiring abstraction: the creation of a network of signs and meanings through responding to a listening environment with a musical language, as opposed to sounds from everyday life. Chion refers to this as ‘semantic listening’.

Smalley has distilled Schaeffer’s modes into three relationships. Partially established with reference to Ernest Schnactel’s theories on subject-centred and object-centred perception (termed autocentric and allocentric perception respectively) the three relationships are defined as

1. The indicative relationship - corresponds to Schaeffer’s mode 1 - sound as message about environmental occurrences; object-centred and can be received either passively or actively.

2. The reflexive relationship - corresponds to Schaeffer’s mode 2 - it is subject-centred and generally passively received; involves emotional response to the object perceived but with little or no further exploration.

3. The interactive relationship - combines Schaeffer’s modes 3 and 4 as a form of ‘reduced listening’ - object-centred and assumes “an active relationship on the part of the subject continuously exploring the qualities and structure of the object. In this sense it can be regarded as interactive.”

Smalley suggests that the ‘indicative field’, “comprehends relationships that are mimetic,” following that mimesis in music, as in drama, is the conscious and unconscious representation of nature and culture. He recognises that the ‘indicative field’ may be considered a musical branch of semiotics as there are clearly, “signifiers and signifieds at a variety of levels and orders.” He also argues that the indicative field exists beyond the mere physical level

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86 Smalley 100

87 Smalley 84.

88 Smalley 84.
and can include emotional and psychological experiences; a link between the psychological rendering of sound worlds, even when there is no physical act or gesture apparently attached.

Smalley’s ‘interactive relationship’ is important, because it attempts to overcome a shortcoming in Schaeffer’s idea that acousmatic sound always encourages ‘reduced listening’. As Chion suggests, the acousmatic experience can (at least in the first instance) intensify causal listening when repeated exposure to the sound is not present.

Most sound design, whether in film or theatre, is predicated on causal listening modes of reception designed to initially be actively perceived, and then passively received on subsequent iterations. Schaeffer’s notion of ‘passive reception’ as modified in Smalley’s reflexive relationship, suggests that any emotional response is entirely subjective and transitory; whereas the ‘interactive relationship’ (as a function of ‘reduced listening’) affords potential emotional, physical and aesthetic responses through changes in quality and timbre.

Given that neither Schaeffer nor Smalley’s listening modes can be separated or received as isolated events, it is important - from the perspective of sound design - not to design hierarchical classifications of auditory stimuli that subjugate causal listening, but rather to enrich causal listening with an ever-evolving development of sound as an influence on perception. Chion emphasizes this criterion in observing that

> Perception is not a purely individual phenomenon, since it partakes in a particular kind of objectivity, that of shared perceptions. And it is in this objectivity-born-of-intersubjectivity that reduced listening, as Schaeffer defined it, should be situated.⁸⁹

⁸⁹ Chion 29.
Surrogacy as Sound Gesture

‘Surrogacy’, by Smalley’s own definition is “the existence of new types of sounds which are more remote from physical, gestural origins than was previously possible…and can be recorded as they occurred in their original, cultural context and be incorporated in a musical work.”

He defines three types of surrogacy as

1. First order surrogate - an identifiable instrumental sound-source, irrespective of whether it normally has a musical connotation or not. It also includes synthesized sounds where they are representing a known instrument.

2. Second order surrogate - a sound with created spectro-morphologies that has no apparent link to an identifiable sound. The human gestural activity does not give a precise explanation for what is heard.

3. Remote surrogacy - physical origins of the sound are masked to a point where neither gesture-type, nor source of the sound can be identified. The gesture field operates within the psychological domain relying on the listener to exercise considerable gestural imagination.

Inherent in the concept of surrogacy is that, “music, and electro-acoustic music in particular, is not a purely auditory art but a more integrated, audio-visual art.” As Smalley points out, this suggests some kind of synaesthesia, whereby the process of, “secondary sensation in one field is produced by a primary stimulus in another.”

The principles of field relationships and surrogacy become an important constituent in a composer’s toolbox of sound design when extrapolations of these principles can be handled empirically in an audio-visual medium, such as

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90 Smalley 85.
91 Smalley 90.
as the proposed MaxStage. It is a requisite of all such components within a hierarchical system model that contextual applicability of components - whether used singularly or as layers - are determined by a consistent approach to the laws governing perception; and through perception, to arrive at an implied meaning.

In the same manner that Schaeffer’s theory of ‘reduced listening’ can be broken down into a set of subsidiary constructs, a similar reductive process can be applied to the constituent parts in designing auditory stimuli. This process is regulated by an awareness of the semiotic considerations of the physical (actor gesture / movement, object as sign, etc.) combined with appropriate sonic figurations mediated through precisely determined and imposed layers of listening.

**Listening in a Sounding Space**

Smalley proposes that the connectedness of space and the relational structure of content within that space cannot be treated separately. He proposes that there are, conceptually at least, three categories of relational structure.\(^93\) These are

1. The relationship and behaviour among sounds within the composed musical space.

2. The movement between successive musical spaces, or the transformation of space in the work.

3. The interaction between the musical space and the listening space which for the listener is the sum of the three categories.

The composed space, as suggested by Smalley, possesses an “acoustic topology” in which, theoretically, the listening space is enclosed.\(^94\) He

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\(^93\) Smalley 91.
\(^94\) Smalley 91.
concludes that perceived musical space “is always a superimposed space.”95 If it can be shown, as Smalley contends, that the “superimposition of spaces can create ‘consonant’ or ‘dissonant’ relationships between composed and listening environments changing indicative interpretations to an extent often not envisaged, or even considered, by the composer,”96 then the need to devise a sound design process that incorporates how superimposed space is perceived becomes increasingly relevant. The importance of this proposition is supported by David Worral’s theory which states: when background ambience is complex and variegated, the distinction between ambient and non-ambient sounds is made clearer, as it is the ambience itself that “creates the space in which other sounds are heard.”97

Superimposed spaces further indicate that layers of auditory stimuli are present. As Katharine Norman argues, “the composer [or sound-designer] can offer superimposed layers of sonic transformation while appearing to preserve the temporal duration of real-world scenario.”98 This implies that a degree of planning is necessary to coordinate the use of variegated ambient sound (whether diegetic or non-diegetic) that acts on multiple temporal planes simultaneously.

The philosophies outlined above indicate that the creation of a virtual System Model incorporating superimposed composition and listening environments is justifiable; not only for testing the applicability of designed auditory stimuli, but to explore different relational fields of visual and sonic experience.

In themselves, acoustic topologies of listening in a sounding space do not configure a sound world that will encompass the intended emotional

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95 Smalley 91.
96 Smalley 91.
Norman refers to this as ‘vertical montage’. She is careful to acknowledge that this term should not be confused with the Russian cinematic auteur, Sergei Eisenstein’s use of this term, as quoted in S. Eisenstein, Notes of a Film Director (New York: Dover, n.d.).
spectrum of response. Smalley contends that to achieve a true indicative contribution depends primarily on how well the composer circumvents the confinement of the superimposed, listening space. In other words, is the listener transported to a real or imagined environment beyond the immediate walls, or is the listener in the midst of musical activity within the space? Is it a case of ‘reaching out’ or of ‘closing in’?99

How is this explained in a specific narrative context? At various instances in Rebecca - The Musical, it is intended that the percipient be transported to the imagined reality and dimension of the ghost-of-Rebecca’s world. Psychic distance from the present tense narrative is maintained by using heavily processed sounds (remote surrogacy) to indicate the ghost-of-Rebecca’s omnipotent presence, contrasting with moments of intimacy, established through a reflexive and/or interactive relationship with first or second order surrogate sounds. In this way, the percipient retains a closer aural dimensionality to the source of the action. The use of remote surrogacy to indicate the ghost-of-Rebecca is further enhanced by overlaying real-world environmental sound sources, thereby expanding the listening space; and, as Smalley denotes, “either transporting the listener beyond the listening space or creating a larger space for the listener to inhabit.”100

Domains in a Sounding Space

Theo van Leeuwen has identified six semiotic ‘domains’ to describe the function of sound. They are

1. Sound perspective and social distance

2. Sound time and rhythm

3. The interaction of voices

99 Smalley 92.
100 Smalley 92.
4. Melody

5. Voice quality and timbre

6. Modality

Van Leeuwen contends, “the semiotics of sound concerns itself with describing what you can ‘say’ with sound, and how you can interpret the things other people ‘say with sound’.”\(^{101}\) Leeuwen prefers the term ‘meaning potential’ rather than the term ‘code’, as often used by semioticians. As he sees it, this distinction is significant because the term ‘code’ implies literal transference of meaning; whereas, ‘meaning potential’ allows additional information to be received before a level of event perception is conveyed in its entirety. It is not simply a matter of putting, as he suggests, “the round pegs in the round holes” but effecting a more durable stance whereby, “semiotics can be a tool for design.”\(^{102}\) The first two domains are particularly relevant to the issues of sound design in a listening space as described previously. Domains 3 - 6 are less relevant in this context as they relate to verbal utterances and pitch-specific music.

**Domain 1.: Sound Perspective**

Sound, according to Leeuwen, creates a relation between the subject it represents, and the receiver(s) it addresses. He argues that this is managed in two ways. The first way is by perspective, whereby sound can be placed either in the foreground, middle ground or in the background. Murray Schafer codifies the environmental distribution of sound perspective by defining ‘Figure’ as the actual sound signal; the focus of interest, ‘Ground’ as the immediate setting or context, and ‘Field’ as the place in which the ‘Figure’ is represented; the soundscape.\(^{103}\) The relative condition of Figure, Ground and Field is, as Leeuwen observes, “the way such a relation has been

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\(^{102}\) Van Leeuwen 10.

\(^{103}\) R. Murray Schafer 157.
created for the listener in sound mixes, musical compositions and so on…”

The fact that Leeuwen separates the act of ‘sound mixes’ from ‘musical composition’ is significant. By doing so, he expands Schafer’s notion of ‘Field’ to potentially include the musical score as the soundscape. This delineation is important, particularly when considered in relation to Smalley’s concept of the ‘indicative network’.

The second way is by means of social distance (one of Smalley’s archetypal fields). The degree of formality that distances the signifier and the receiver (defined as intimacy, informality or formality) reflects a tangible meaning potential. Furthermore, social distance is normally conditional upon sound perspective. One further related aspect of sound perspective is the way in which sound acts dynamically. As Leeuwen states, “it can move us towards or away from a certain position [and] it can change our relation to what we hear.” This is equivalent to Chion’s axiom that sound presupposes movement in relationship to the associated visual stimuli.

**Domain 2.: Sound Time and Rhythm**

Leeuwen views unmeasured time as a "particularly apt signifier for ‘eternity’ - it literally negates time and goes ‘on and on’.” In *Rebecca - The Musical*, this device is used to signify the relationship existing between the ghost-of-Rebecca and the sea; the ‘sea’ being a recurring leitmotif which indicates the passing of time, both forwards and backwards in the dramatic narrative. It is also used a sonic metaphor consistent with Field’s theory of ‘sonic objectification’. Similarly, the evocation of the supernatural portrayed by Rebecca’s omniscience, is underpinned by Leeuwen’s proposition that, “the musics and sound effects that signify supernatural events not only tend to use ‘non-human’ instruments … but also ‘non-human’ forms of timing.”

Leeuwen proposes that there are two main kinds of unmeasured time

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104 van Leeuwen 17.
105 van Leeuwen 18.
106 van Leeuwen 7.
107 van Leeuwen 53.
1. *continuous time* - which lacks any form of phrasing and either does not vary in pitch at all, or wavers in pitch in slight or irregular ways, and

2. *fluctuating time* - which also lacks phrasing, but does shift between different pitches, at more or less regular intervals which are, however, too long to produce a clear sense of regular pulse or periodicity.\(^{108}\)

As such, aesthetic meaning can be invested in the action through the contradiction of auditory events portrayed in time measured, as compared to those perceived in unmeasured time.

Upon reflection, there are significant similarities expressed amongst theorists in the disciplines of theatre semiotics and the ontology of listening perception and reception. The requirement to maintain a causal connection between action and perceived outcome, whether the action is a result of visual or aural stimulation is consistently articulated. This does not, furthermore, preclude the use of sounds whose surrogacy levels involve a relationship remote to the perceived action (whether it be movement, gesture or narrative dialogue).

Intending meaning through additional auditory stimulus is not as important as eliciting an emotional response that directly supports the semiotic considerations of the drama. Without a fixed POV in the theatrical setting, cogency between visual, textual and sonic artefacts should be predicated upon a strict observance of the accepted classification of mimesis. In its most concise form, the poetics of Aristotle - as discussed in more detail in Chapter Three - provides a manageable framework in the development of a taxonomic system for sound design as a dramaturgical device in its own right.

\(^{108}\) van Leeuwen 54.
Evoking simultaneous layers of experience requires the development of an aural imagination whose elements can be codified, not only for evaluative purposes, but also as a means of systematically organizing the construction of a model in which that aural imagination may be mediated.

It is similarly apparent that the manner in which auditory stimuli behave in spatial terms, in relation to intended semiotic significations, also impacts on the system design model.

In Chapter Three our attention will shift toward issues in interface design as a function of the articulated semiotic and aesthetic attributes of the prescribed taxonomic system.
CHAPTER THREE

**Human-Computer Interface Design: Processes in Collaborative Drama**

As semiotic, the computer becomes an instrument for epistemological ‘play’. It becomes a tool for constructing the representations with which as yet unimagined worlds might be realized - an environment in which the outcome of an interaction cannot be determined beforehand.  

Having considered the aesthetics of dramatic performance in semiotic terms, the focus of the discussion shifts to considerations for the design of a virtual interface (The MaxStage) to encapsulate these constructs. Three key concepts frame the design process:

1. How are the ideas of the composer and the sound designer, expressed in terms of individual ‘aural imaginations’, to be mediated?

2. How does the collaboration between the composer and sound designer further mediate ancillary design considerations?

3. What effect will the virtual interface have on the relationship between stage director and sound design activities?

Establishing a valid syntax for the design of The MaxStage relies on identifying a logical connection between the semantics of drama and the lexicon of established operands employed to navigate computer interface environments. Brenda Laurel has expounded a specific philosophy in human-computer interface design framed by these terms of reference.

Laurel’s pioneering work in this field of investigation has not been developed to any significant extent by other researchers. Her work is quoted substantively throughout this chapter as her theories on the interrelationship between interface design, as an analogy of narrative construction in stage drama, is the cornerstone of the ‘system generative prescriptive’ for The MaxStage.

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The System Generative Prescriptive

Laurel has expressed the virtues of improving the “quality of human-computer experiences through new approaches to their design.” A protégé of Alan Kay, Laurel spent several years developing human-computer interface designs for computer games for the Atari Computer Corporation. Before this, she had been an actor and graduate student in theatre. Her conceptual framework is self-admittedly orthogonal compared to more traditional interface theory and technique and derived from a sense of “the relevance of dramatic theory and practice to interactive media.”

Laurel’s views on dramatic theory and criticism resonate with the semiotic theories of Esslin (et al.). From the earliest developments in computer-games, Laurel has believed that the computer’s “interesting potential lay not in its ability to perform calculations but in its capacity to represent action in which humans could participate [Laurel’s italics].” Similarly Esslin believes that “the most basic sign system by which the designer contributes to the complex interaction of signifiers that generate information and meaning in a dramatic performance, even before he presents an iconic or symbolic ‘picture’, is that of the infrastructure of ‘spaces’ he creates [Esslin’s boldface].” Hamman reinforces Laurel’s ideology believing, “interface metaphors work by relating tasks associated with the computer to task domains outside of that which would otherwise encompass use of the computer.”

The design of any generic human-computer interface implies that a level of interaction (irrespective of the degree of complexity) will exist between the user and the way the computer responds to human input. This concept of ‘common ground’ is referred to by Laurel as a “jointly inhabited ‘space’

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109 Laurel xx.
110 Alan Kay worked at Xerox PARC in the 1970s on the GUI interface and object orientated programming languages. In the late 1970s, he undertook work with the Atari Computer Corporation in developing applications for computers in education whilst simultaneously evolving theories in the user-interface for computer games. During the 1980s, Kay acted as a consultant to Apple Computers, Inc., overseeing their interface system design. Throughout the 1990s, he oversaw the development of multimedia products for the Walt Disney Corporation.
111 Laurel xx.
112 Laurel 1.
113 Esslin 72.
114 Hamman 92.
where meaning takes shape through the collaboration and successive approximations of the participants.”

Referring to the ideas of Donald A. Norman, Laurel further argues that “the design of an effective interface - whether for a computer or a doorknob - must begin with an analysis of what a person is trying to do, rather than with a metaphor or a notion of what the screen should display.” Laurel identifies that in this jointly inhabited space (or arena) specific roles are taken by both the human and the computer.

An alternative definition offered by Hamman refers to this jointly inhabited space as a ‘mechanism’ by which a set of appropriately described cognitive interactions take place.

Laurel claims that there are three variables associated with interactivity. These are

1. The frequency of the interaction
2. The range of choices available at any given instant
3. The significance of the choices made on the action

She further subscribes to the view that an even more rudimentary measure of interactivity is defined by the level and extent to which the human is participating in the ongoing action. Consequently, it becomes vital according to Laurel that “sensory immersion and the tight coupling of kinaesthetic input and visual response” are closely knit. Hamman supports

It is important to recognize that GUI design for computer applications is considerably advanced since Norman (1986) and Laurel (1993) made these observations. Available options in screen display are now acutely tied to the design phase of the application. Earlier computer applications were often designed by individuals and colloquially referred to as “The Lone-Ranger” effect. The current trend is toward ‘teams’: each member of the team responsible for a discrete aspect of the overall design process.
this contention by arguing that signals acted upon need to be oriented to “modes of interaction with respect to that signal.”

The sensory state of ‘immersion’ or ‘being immersed’ as a preferred condition for percipients in contemporary multi-modal presentations (whether film, computer-games, live spectacle, theme-park attractions etc.) should be viewed with caution. Complete sensory immersion, in itself, is not an adequate predictor of an enriched sonic-visual experience. The argument for establishing a state of sensory immersion is predicated on being able to accelerate the onset, or point of arrival, at catharsis. There are several problems, however, associated with this concept: for example, catharsis is conditional upon the individual response of the percipient subjectively agreeing to be immersed in such an environment. This should not be taken for granted. Laurel suggests that it is better to think in terms of reaching a sense of ongoing understanding and resolution of the action. She contends this is possible through good human-computer interface design, wherein a means to serve and reinforce the drama at any given moment throughout the play is established.

Creating a sense of immersion, as a conditional state, is not the priority in designing The MaxStage. The MaxStage’s graphics, for example, are rudimentary; specific scenography with respective lighting states for any scene, are not displayed. It is, nonetheless, an important criterion for consideration given the objective of establishing a means to mediate ideas between members of the creative team.

### The Design of an Interface

Laurel proposes that the design of computer-human experiences needs to be “structured around the fundamental precepts of dramatic form,” and those structures based “primarily on Aristotelian poetics - poetics being a term of

121 Hamman 91.
122 Whereas Aristotle defined catharsis as occurring at the end of a play, Berthold Brecht was adamant that this point of arrival could only occur post-performance.
123 Laurel 35.
used to describe a body of theory that treats a poetic or aesthetic domain.”

She justifies this proposition by arguing that, “in order to build representations that have theatrical qualities in computer-based environments, a deep, robust, and logically coherent notion of structural elements and dynamics is required - and this is what Aristotle provides.”

Describing this as a *poetics of interactive form* Laurel clarifies ‘interactivity’ in this context as, “the ability of humans to participate in actions in a representational context.” Unlike Brecht who, according to Laurel, persuasively amended Aristotle’s poetics on certain points, “no one has presented a fully alternative view of the nature of the drama that has achieved comparably wide acceptance.”

Sam Smiley contends that, in neo-Aristotelian terms, there are six qualitative elements of drama. These elements are organized in terms of formal material causality. The trick to understanding them, as Laurel points out, is recognizing that, “each element is the formal cause of all those below it, and each element is the material cause of all those above it.”

Laurel provides the following table (Table 2.) depicting her transposition of the six Aristotelian elements in drama, in terms of their causal relationship to human-computer interaction.

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124 Laurel 36.
125 Laurel 36.
126 Laurel 35.
127 Laurel 36.
129 Laurel 49.
Table 2
The Six Qualitative Elements of Structure in Drama and in Human-Computer Activity.\textsuperscript{130}

<table>
<thead>
<tr>
<th>Element</th>
<th>In Drama</th>
<th>In Human-Computer Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Action</td>
<td>The whole action being represented. The action is theoretically the same in every performance.</td>
<td>The whole action as it is collaboratively shaped by system and user. The action may vary in each interactive session.</td>
</tr>
<tr>
<td>Character</td>
<td>Bundles of predispositions and traits, inferred from agent’s patterns of choice</td>
<td>The same as in drama, but including agents of both human and computer origin.</td>
</tr>
<tr>
<td>Thought</td>
<td>Inferred internal processes leading to choice: cognition, emotion, and reason.</td>
<td>The same as in drama, but including processes of both human and computer origin</td>
</tr>
<tr>
<td>Language</td>
<td>The selection and arrangement of words; the use of language.</td>
<td>The selection and arrangements of signs, including verbal, visual, auditory, and other non-verbal phenomena when used semiotically.</td>
</tr>
<tr>
<td>Melody (Pattern)</td>
<td>Everything that is heard, but especially the melody of speech</td>
<td>The pleasurable perception of pattern in sensory phenomena</td>
</tr>
<tr>
<td>Spectacle (Enactment)</td>
<td>Everything that is seen</td>
<td>The sensory dimensions of the action being represented: visual, auditory, kinaesthetic and tactile, and potentially all others.</td>
</tr>
</tbody>
</table>

Action

It is key to the success of a dramatic representation that all of the materials formulated into action are drawn from the circumscribed potential of the particular dramatic world. Whenever this principle is violated, the organic unity of the work is diminished, and the scheme of probability that holds the work together is disrupted.\textsuperscript{131}

Bracewell reinforces Laurel’s assertion as he states: “sounds used in a production cannot be independent of the atmospheric and geographic

\textsuperscript{130} Laurel [Table 2.1] 50.
\textsuperscript{131} Laurel 58.
environment of the drama.” He further concludes that, “in order to use auditory images as an aesthetic concept we need to single out the most essential characteristics of sounds in terms of tonal quality, spectral character, duration, and so on.”

The circumscribed potential of a Musical is derived from the musical score and the book/lyrics. If we add potential through enriched sound design, formulated in a virtual working space, the tenet of not violating organic unity holds equally true. Whilst the score/book/lyrics remains the pivotal reference point, succeeding sonic material drawn into the action may also become self-referential; not only to a single isolated event, but to all subsequent occurrences of related events. It is important, therefore, to be able to adequately codify the function of all interrelated events (musical, auditory, character, movement, gesture and action) elemental to all aspects of stage direction. The system taxonomy, therefore, requires all these elements to be visible and operable by both the system and the user. A system taxonomy will include music and sound along with basic animation and any available video support. A more sophisticated system might additionally include attributes of intended scenography, representational lighting states and the capacity to locate sound beyond the default monophonic or stereophonic image.

**Character and Agency**

In Aristotelian terms an ‘agent’ is one who takes action, suggesting that “agency as part of a representation need not be strictly embodied in ‘characters’…that is, as representations of humans.” If agency does not need to be described by the actions of characters, what then, can it also describe? Laurel conjectures that an agent could be a “free-floating’ aspect of what is going on…..” If this is true, then agency may be seen to be exteroceptive; that is, as existing outside the actions of the character to accentuate the action with appreciably greater clarity. This view of agency would support paradoxical actions by characters - a fundamental precept in dramatic

132 Bracewell 219.
133 Bracewell 220.
134 Laurel 60.
135 Laurel 60.
exposition. Laurel contends that this view of agency requires consideration because, “part of the art of creating both dramatic characters and computer-based agents is the art of selecting and representing external traits that accurately reflect the agent’s potential for action.”

Predisposing ‘what is possible?’ in the design process also has an undeniable experiential component. Constructing a system taxonomy that will elucidate every single possibility and one that will provide irrefutably ‘correct’ decisions is neither practically feasible nor warranted. A system taxonomy, however, that delimits the range of appropriate decisions through a series of hierarchical considerations is beneficial. Ultimately, determining how representational actions convey “emotional and intellectual satisfaction” to the percipient must be built-in to the human-computer activity design.

‘Agency’ may also be defined as the ability to control agents in differing situations and to incorporate learned prior knowledge of action into the way the system subsequently responds. Contingent upon this idea, as Hamman suggests, is that all specified representations constitute, “the agency through which an interface is embodied by orienting a particular way of conceiving and understanding a signal.” This notion is central to the ideas of gestalt-based performance in the physical design of multimodal environments as developed by Camurri and Leman, and Modler, and discussed in Chapter Four.

Ultimately, the efficacy of theoretical frameworks to the task of designing meaningful, engaging, and emotionally satisfying auditory stimuli within a human computer interaction relies, as Laurel describes, on “the relationship between form and experience, in terms of both the ways in which form influences content and the direct impact of the formal and structural qualities of a work on human thought and emotion.”

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136 Laurel 61.  
137 Laurel 67.  
138 Hamman 91.  
139 Laurel 93.
Thought

Laurel proposes that the material causality of thought should deal only with, “what is already manifest at the levels of enactment, pattern and language [Laurel’s italics].”\textsuperscript{140} From a performance perspective, the delivery of any form of narrative is an extension of the thought that precedes it. This thought process, as deliberated through the actor, determines in what manner the narrative is delivered, and subsequently received by the percipient. Actions that preclude this thought process appear unconnected to the drama. Similarly, sound design conceived to suggest thought, should not be an occurrence that appears, as it were, ‘out of the blue’. Laurel further suggests that, “the element of thought ‘resides’ within characters, although it can be described and analysed in aggregate form.”\textsuperscript{141} Analysis on this level, in a Musical, should be directly attributable to the conceptual framework of the composer and author. Consequently, as re-enacted in the vision of the stage director, predispositions of thought by characters, further reinforced by any additional auditory stimuli, should maintain this level of consistency in thought process. Therefore, a collaborative communication model should, at the very least, enhance this process.

Language

It is assumed here that the spoken word is not the only possible form of language. Language, according to Laurel, can be expressed in a way, “that takes into account the sensory modalities available to the audience.”\textsuperscript{142} Unlike ‘thought’ however, we are dealing with a direct expression of action, rather than an implied association reflected by speech or gesture. Designed auditory objects, delivered as a non-verbal form of utterance, can be used as an explicit form of communication replacing speech or other verbal forms of communication. The same could be said of lighting, projections and animation, or other visual signs. As one example, Laurel correctly identifies the paralinguistic elements of sign-language, for hearing-impaired audiences, as a direct form of language reliant only upon visual acuity.

\textsuperscript{140} Laurel 58.  
\textsuperscript{141} Laurel 57.  
\textsuperscript{142} Laurel 56.
**Pattern**

Laurel is candid in accepting that the concept of pattern (melody) is insufficient as proposed by Aristotle - the problem being: the formal and material causality of all sounds are not only perceived by the eye (spectacle). Pattern, nonetheless, can be explained as, “patterns in the sensory phenomena of the enactment. These patterns exert a formal influence on the enactment, just as semiotic usage formally influences patterns.”\(^\text{143}\) Just as non-attributable sound design without causality of thought (irrespective of which mode of reduced listening is being employed) weakens overall dramatic coherency, so disassociation through unrelated patterning will equally affect the percipient’s response to the narrative.

**Enactment**

Once enactment is in place, two issues frame the causal relations among elements of quantitative structure. According to Laurel these are

1. The magnitude of the enactment overall

And

2. The extent to which the granularity of action can be grouped into a larger, more meaningful coherent unit.

From the perspective of auditory design: being consciously aware of how to delimit the magnitude of auditory stimuli, so as not to detract from the main purpose of the enactment, is equally as important as defining auditory objects that will be coherent (probably through patterns of use) over the length of the narrative. The facility to recall auditory objects for comparison and re-use, therefore, is an important consideration in the design of a human–computer interface to model sound design.

In summary, Laurel defines three key issues that support the notion of drama

1. Enactment - involves direct sensing as well as cognition

\(^\text{143}\) Laurel 55.
2. Intensification - intensify emotion and condense time

3. Unity of action - central action with separate incidents that are causally linked

To achieve this effectively, Laurel argues that, “artistic sensibility must drive the notion of desired experience [Laurel’s italics] from which the design of technological components must be derived.” This edict is useful for the design of auditory stimuli as dramatic objects in Musicals, because of the multi-layered and multifaceted dependencies that co-exist.

Laurel’s adaptation of Aristotle’s six qualitative elements of structure in drama provides a structural basis for the architectural flow of information in the system model as envisaged. In particular, the elements of ‘character’ and ‘thought’ are shown to have direct associations with semiotic considerations in predisposition and pre-enactment of agents respectively, whilst ‘language’ suggests relationships with indexical modes of listening and sound perspective, as previously outlined in Chapter Two. The elements of ‘character’, ‘melody’ and ‘spectacle’ furthermore, have a direct bearing on the potential of The MaxStage to function in tandem with an ICMS, an explanation of which is pursued in the next chapter.

It is worth keeping in mind, as we continue to develop the framework informing the System Model, that The MaxStage virtual environment provides a visual and sonic reference to test auditory design information based on these neo-Aristotelian structural precepts.

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144 Laurel 98.
CHAPTER FOUR

Interactive Music Systems

Sound design for Musicals requires a different aesthetic to that of performance art, sound installation or real-time generative computer-music performance practice. This aesthetic differentiation is fundamentally one of incorporating interactivity into an ostensibly linear narrative model. This notwithstanding, interactive sound design is a new opportunity for enhancing the theatrical Musical experience.

Within the constraints of a fixed linear narrative, it is still possible to treat interactivity as a gesture with finite boundaries in terms of both physical action and time displacement. Rather than considering interactivity as a major determinant of overall narrative structure or organizational creativity, it is possible to conceive interactivity as a fixed gestalt mechanism: its applicability and inclusion determined by the presence of appropriate representations of agency.

When considering any form of interactivity involving response to a physical gesture or movement (representations of agency), the mapping of gesture or movement is critical to the way the receiving system responds. Understanding the processing chain for gaining appropriate responses to representations of agency is the first step of interaction design for The MaxStage. Robert Rowe conceptualises the processing chain of interactive computer music systems in three stages:

1. The sensing stage (Machine Listening) - data collection from controllers
2. The processing stage - interpretation of information from sensors
3. The response stage (Machine Performing/Composing) - computer and sound-processing devices contribute to a musical output\(^\text{145}\)

This three-stage process is similarly described by Wright, (Figure 5.) taking into account that data collected at the sensing stage needs to be measured and mapped prior to the processing stage.\textsuperscript{146}

![Three-stage process diagram](image)

**Fig. 5.** Matthew Wright, Structure of a Sensor-based Control System for Control of Sound Synthesis

Whilst the mapping system itself remains transparent to the percipient, the algorithms employed in defining the type of sonic objects able to be created are conditional upon the auditory outcomes relevant to the intended experience. This means that being able to describe the sonic outcomes, in at least general terms, need to be known before a gestalt described ICMS can be built. This is one of the fundamental differences in the musical theatre context, as compared to discrete algorithmic computational systems, where the outcome is intended by design of the properties of the algorithm itself.

**Concept of Gestalt in the System**

![Two-channel ICMS diagram](image)

**Fig. 6.** A Simple Schematised Model of a Two-channel ICMS

By definition, a gestalt mechanism must, when viewed as a whole, be more than the sum of its parts. Paul Modler’s schematised model of a two-channel ICMS demonstrates how the gestalt is formed through the interactions between the performer and the ICMS.

\textsuperscript{146} Matthew Wright, “Problems and prospects for intimate and satisfying sensor-based control of computer sound,” Sensors and Input for Multimedia Systems (SIMS) ’02, June 20-21, 2002 (Santa Barbara, CA: Research/SIMS2002/Wright-SIMS2002.pdf)
interactive computer music system (Figure 6.), with abstract information content, is an example of an auditory perception gestalt mechanism.\footnote{Paul Modler, "Interactive Computer Music Systems and Concepts of Gestalt," \textit{Studies in Cognitive and Systematic Musicology}, ed. Marc Leman (Springer-Verlag: Berlin, 1997) 487.} Modler acknowledges that Gestalt, as interpreted in this system, is less to do with gestalt theory as usually applied to the investigation of perception, and more to do with a Gestalt-quality of interpreting abstract information through auditory perception.

K1 represents a data stream, which can be either MIDI or audio, and k2 is a system response in pure audio. Channel, according to Modler, is defined by two possibilities

1. Related to a mental idea (imagination) and the corresponding concept of its realization: k1 represents a human transmitting information to the system and intending Gestalt 1.

2. Related to a perceivable change of the systems behaviour: k2 is a response from the system transmitting information to a human and evoking Gestalt 2.

k1: An imagined sound is transferred to the ICMS where a sound generation algorithm acts upon that imagination. Correspondingly, the anticipated imagination of sound may change one or more parameters in the structure of that algorithm. Additionally, the design of the system should be such, that decisions defining the manner in which the sound generation algorithm responds should include the possibility of altering the criteria of response or, in the very least, the way in which the system responds to handling.

k2: Similar to k1 but assumes that the performer is required to decode the abstract information of sound waves in a manner commensurate with the decoding algorithm of the ICMS.
Most importantly, Modler argues that the intended Gestalt 1 and Gestalt 2 are both produced within the performer’s knowledge representation of their own fictional world.

Why is this concept of gestalt in an ICMS important? It demonstrates that the human (or ‘actor’ in Laurel’s terms) receives information to which he/she may need to respond through Gestalt 2. This response, although not necessarily different in appearance from reaction to another character (or agent), is generated from a different source (or agency).

For the actor, the appearance of being oblivious to any source (whether it be agent or agency; physical or auditory) designed to initiate perceptual feedback from the audience, weakens the overall perception of dramatic coherency. This poses a problem in designing a system taxonomy that can handle an appropriate array of responses from a simple two-channel system. Inevitably, a cyclic loop of human-system response occurs, until the system no longer sensorily measures any activity. Delimiting a gestalt mechanism is therefore, an important design criterion when creating auditory stimuli. A simple methodology to constrain sensory measurements in a gestalt mechanism is to define two or three-dimensional zones or boundaries as part of the system taxonomy.

**The Frame of Reference for a System Taxonomy**

Modler defines a system taxonomy for a gestalt-driven ICMS in the following manner

1. **Proximity - Continuity**: system should behave deterministically; small changes should trigger small results.

2. **Discontinuity**: the opposite feature: rendering an abrupt change in Gestalt 1 should correspond to similar changes in Gestalt 2.

3. **Relatability (Similarity)**: similar user inputs should result in similar system outputs; the control input at two different times by the user,
should result in the same effect or consistent change in parameters, for example, in a Max/MSP patch.

4. Responsiveness: the reaction time has to be within the limits of aesthetic, senso-motoric and perceptive constraints although the response value can vary depending on the Gestalts to be transmitted.

5. Variability: the number of signs that can be transmitted; as well as the possibility of continuous, fluid changes between these signs.

6. Autonomy: the degree of local intelligence within the ICMS. The system has to have appropriate rules for intelligence. Resulting outcomes need to be within an acceptable range within the mental conception and imagined response of both the performer and the audience.  

**Multimodal Environments**

Multimodal environments are classified by Camurri and Leman as “particular extensions of augmented reality environments integrating intelligent features. The concept of augmented reality pertains to digital extensions of humans acting in a natural reality [Camurri and Leman italics].”

According to Camurri and Leman, multimodal environments should be able to

1. Interpret sensor-data to extract high-level information with the aim of recognising gesture and audio gestalts

And

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148 Modler 488-89
2. Use this information for adapting their behaviour and response to user input. In their words, “multimodal environments should...be able to change their reactions, their social interaction and rules over time.”  

The second of these criteria is synonymous with Modler’s k2 Gestalt, as described previously. Camurri and Leman further contend that multimodal environments should “embed multilevel representations of communication metaphors and of analogies to integrate modalities,” which extends not only the response level of the system but the extent to which a gestalt mechanism acts autonomously. This ideology is conceptually similar to approaches in creating and managing ‘adaptive audio’ objects for computer games.

Whereas, Camurri and Leman acknowledge that, “virtual environments...are usually conceived of as static environments in the sense that they can be explored and navigated by users,” this premise (that virtual environments do not, as a rule, change their structure and behaviour over time) is not inconsistent with their concept of musical gestalt. This stance is predicated upon the criterion that their proposed ICMS is not conceived to function primarily on a hierarchical compositional level as part of an overall taxonomy of musical language, but predominantly at the level of user interaction.

Requirements for Multimodal Environments

The basic requirements for an ICMS as envisaged by Camurri and Leman are that

1. The technology should be transparent both in the off-line design phase and in the performance application. This requires sensor system technology that is wireless, low-cost and precise in gesture recognition.

150 Camurri and Leman 497.
151 Camurri and Leman 497.
152 Camurri and Leman 496.
And

2. A real-time supervision system (such as Max/MSP) to manage the multi-modalities and timing of events in the interactive environment. This is more than a matter of synchronization. Each agent should be seen as “having its own goals and character, capable of establishing and conducting creative, adaptive, intelligent interaction with users.”

This dissertation does not examine advancements in sensor system technology, because the rapidity of change in this technological field militates against its inclusion. The type of sensor used is determined by the question, ‘what is to be achieved’? Decisions in a theatrical context pertaining to the use of sensor technology are the responsibility of the Technical Director in consultation with the Sound-Designer. From the composer’s perspective, the actual physical nature of the sensor is not particularly relevant. The physical nature of the sensor may be relevant to the Stage Director, and even Costume and Wig Department, if the sensor mechanism is not transparent. For example, using a sensor-glove, bodysuit, or physical controller is potentially visible to the audience.

Instigating Camurri and Leman’s notion of a real-time supervision system is extremely complex when the overall taxonomy of musical language (especially within a linear narrative structure, such as the Musical) is the point of auditory reference, and not the domain of just user interaction. Nonetheless, the handling of multi-modalities and timing of events needs to be seamless and controllable from any of the modalities.

Classification of Interactive Systems

Robert Rowe classifies interactive systems as either:

• Score-driven programs: pre-composed event collections, or musical ideas, used synchronously with music gestures arriving at the

153 Camurri and Leman 498.
computer’s input. Events are organized using the traditional categories of beat, meter and tempo.

- Performance-driven programs: do not use stored preconceived events or musical fragments. Events generally are not organised by traditional metric categories.

Either system can accordingly respond through the following methods:

- Transformative methods - variants produced from existing material. The source input is a complete musical gesture; material need not be stored in advance.

- Generative algorithms - source material is not a complete musical gesture, but rather stored scales and duration sets, for example. Algorithmic rules define the complete musical output usually by comparing commonalities or random distributions to the source material.\(^{154}\)

Conversely systems with limited interaction at an abstract level are governed by sequenced techniques - the use of pre-recorded musical gestures to be played in response to live input. Any available real-time variations are determined by comparison to traditional metric categories.

*Rebecca - The Musical*, in Rowe’s classification, conforms to a score-driven program. Sound design for this Musical, as part of an ICMS, would employ aspects of both transformative and generative algorithmic methods. The fact that it would not rely solely on either method is a function of the source of agency, i.e., dramatic objects, character, gesture and action as opposed to only sonic artefacts as considered by Rowe.

Certain auditory stimuli in the sound design of *Rebecca - The Musical* are expositions of new sonic thought not attributable to the musical score. As

part of a physical ICMS, a specific generative algorithm (GA) would be used - similar in function to Modler’s k1 Gestalt - the auditory outcome of which would be auditioned in The MaxStage. This type of interactive GA, according to Woolf and Yee-King allows the user to engage quickly and easily in open-ended exploration, and, second, where there are a large number of parameters that map to the final form in a non-intuitive way, exploring the space of possibilities…can be more direct and instinctive than adjusting seemingly arbitrary parameters by hand.¹⁵⁵

**Defining Topographies in an Interactive Computer Music System**

Gesture and movement capture through a sensor field can either be handled two-dimensionally (mapping an x and y co-ordinate) or three-dimensionally, with the inclusion of a perpendicular axis of proximity. Mapping in three dimensions is proportionally more complex.

Rolf Gehlhaar has created a coordinate topography to facilitate gesture capture in a physical system called SOUND=SPACE. Many of his conceptual ideas are applicable to the requirements of a simple two channel ICMS, as devised for The MaxStage virtual environment. Gestural capture in the SOUND=SPACE system is controlled by an ultrasonic, echolocation system. Described by Gehlhaar, “this system consists of a number of ultrasonic ranging devices [USR] each of which is powered, triggered and monitored by a central control unit….”¹⁵⁶ The USR’s are usually set up along two contiguous sides of a square stage, looking inwards, and spaced about one metre apart.

Gehlhaar defines SOUND=SPACE as a musical instrument where “the player-instrument interface…has been dematerialised and replaced by a control topography, a structured space in which the position of the body or any part of the body and activity in certain specific zones of this space

determine the response of the instrument.”

The general philosophy of the physical space of SOUND=SPACE, its body recognition prescriptive, and its applicability to more than one user simultaneously, is a further influence on the design paradigm of The MaxStage.

**Gehlhaar’s Topographies**

Gehlhaar describes five generic topographies defined by any one of the interstices, as reprinted in Figure 7. The number of interstices available on a defined stage space is determined by the number of USR’s deployed. The topographies are defined as:

- KEYBOARDS
- VARIATIONS
- MELODIES
- MUZIX
- IMPROVISATION – a hybrid of KEYBOARDS & VARIATIONS

Gehlhaar further divides each interstice into an inner and outer area thereby giving the performer working inside each defined interstice a much wider range of control.

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157 Gehlhaar 66.
158 Gehlhaar 68.
Fig. 7. Gehlhaar’s Topographies for SOUND=SPACE: an Interactive Musical environment
Three of these topographies are applicable as conceptual frameworks for sound design parameters in The MaxStage. They are: VARIATIONS, IMPROVISATION and to a lesser extent, MUZIX.

VARIATIONS, states Gehlhaar, “responds to the level of ACTIVITY calculated for two concentric zones.” The inner zone controls parameters associated with pitch and the outer zone of parameters associated with rhythm and tempo. Similarly, IMPROVISATION reacts to the level of activity calculated in two zones, these being pitch and duration.

The relevance of MUZIX is that, “a fully determined score is played, regardless of any activity in the SPACE other than the fact that it will stop playing if there is no one present.” This topography is related to the concept of predetermined sequences or any low-level interactive triggered event, not open to variance by the performer.

Using Gehlhaar’s design topography principles, we can now formulate a set of topographical potentials upon which the ICMS may operate in The MaxStage.

According to Bracewell, the controllable properties of sound are: 

- Intensity
- Frequency
- Duration
- Envelope
- Timbre
- Directionality

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159 Gehlhaar 67.
160 Gehlhaar 69.
161 Bracewell 208.
Within a set of x-y coordinates, we can superimpose any two of the six controllable properties of sound. Change in the auditory stimulus occurs relative to the property’s functionality, the closer the actor moves toward the source of agency. For example, the agent may be an animate or an inanimate object: i.e., a person (actor) or a stage property. Two generic examples (Figure 8. and Figure 9.) are shown below.

Figure 8.: as the actor moves closer toward the source of agency the intensity (perception of loudness) of the auditory stimulus increases. As the actor moves gradually from stage right to upstage centre, the auditory object will appear increasingly in the centre of the stereo field.

Figure 9.: as the actor moves further away from the source of agency the frequency (rate of physical vibration) of the auditory stimulus decreases. As the actor moves gradually from downstage centre to upstage right, the auditory object will be heard increasingly left in the stereo field.

Gehlhaar’s SOUND=SPACE system can be configured in a flexible number of zones. Similarly, The MaxStage can be configured as a set of interstices (Fig. 9.) or, as a concentric set of decreasing zones (Fig. 8.) positioned
equidistant from the chosen source of agency. The two main reasons for this reflect Rowe’s representations of ICMS response

1. When configured as in Fig. 8., auditory objects undergo transformative processes as a function of a DSP algorithm designed in Max/MSP. The source of agency (i.e., an actor) triggers an auditory object to undergo transformation by entering the predetermined x-y coordinates: the level of subsequent transformation proportional to the distance from the agent of interaction. It is assumed, that specific movements (or gestures) in the stag- blocking as part of the dramatic exposition will be predetermined by the stage director. Random movement, nonetheless, can be accommodated in this configuration.

2. When configured as in Fig. 9., auditory object designs undergo structural processes, similar in concept to game-rendered adaptive-audio techniques. Each interstice marks a boundary of transition from one adaptive-audio module to the next. Algorithmic rules of the applicable music engine govern the extent of auditory change.

The Techniques of Adaptive-Audio Transitions

Whitmore identifies at least five transition types in adaptive-audio cues.\textsuperscript{162} They are

1. Silence

2. Cross-fade between successive cues

3. Direct splice between successive cues

4. Synchronized overlapping cues

5. Seamless transition between cues:

   • Cue-to-cue:
     Current cue plays until the boundary of the cue is reached, at which time a new cue begins.

\textsuperscript{162} Whitmore 5.
• Layering:
  Addition or subtraction of instrument layers in continuity; may also involve harmonic changes.

• Transition matrix:
  Matrix allows transition between any pair of music cues.

There is a preference toward context-sensitive processes in developing seamless transitions, thereby avoiding the system appearing to respond in a stilted manner and with perceptible time-delays between modules.

Whereas auditory variation achieved through transformative methods may reflect change in a single auditory object, adaptive-audio transitions require all transitions to be composed prior to their possible selection.

Having outlined all relevant constructs of a system taxonomy for handling the design of auditory aura in Rebecca - The Musical, we turn our attention to the actual design and functional operation of The MaxStage theatre interface.
CHAPTER FIVE

The MaxStage Environment

Why Max/MSP?

To paraphrase Winston Churchill, Max is the worst possible solution, except for all the others that have been tried.163

Whilst there are a number of off-the-shelf software programs designed to implement sophisticated representations of movement/gesture through animation, a significant problem is encountered when alternate retraces of these events may be required without significant re-authoring of all the programmable time-based events. As Inwoo Park and Michal J. Hannafin remark (citing Norman), “systems must be designed to accommodate errors – which are highly likely in hypermedia.”164 This single criterion, handled effectively in Max/MSP, is the primary determinant for its use over other programmes.

Miller Puckette, the author of Max/MSP, regards the Max paradigm as “fundamentally a system for scheduling real-time tasks and managing communication among them.”165 He further describes the software programme as a set of pre-made building blocks that can be configured in ways that are useful for real-time computer music performance and composition. Most importantly, Max includes a protocol for scheduling control, component intercommunication and a GUI for patch-editing.166

As flexible and adaptable as it is, Max/MSP is not the perfect authoring tool for The MaxStage. Its secondary graphic objects and ability to create complex animations, although adequate, would be better suited to programs.

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165 Puckette 39.
166 Puckette 31.
such as Macromedia’s ‘Director’.\textsuperscript{167} However, the advantages of Max/MSP include its protocols to schedule the separate components of animation, video, MIDI and audio-rate computations simultaneously. Puckette, himself, acknowledges that “to succeed as computer music software writers…we need close exposure to high-caliber artists representing a wide variety of concerns. Only then can we identify features that can solve a variety of different problems when in the hands of very different artists.”\textsuperscript{168} In light of this, Max/MSP is an appropriate choice to develop a prototype version of a virtual stage environment interface for sound design.

This chapter takes the reader through the component design of each module in The MaxStage. The Max patches are ostensibly hidden behind the GUI. Understanding the operand construction of each modular patch is not necessary to understanding the functional operation of The MaxStage.

**Evolution and Structure of Max/MSP**

In 1988, when David Zicarelli was invited to work at IRCAM, he attended a demonstration of Max (there was no MSP component at this time) given by David Wessel from CCRMA. In subsequent conversation with Miller Puckette, discussion was broached as to the future commercialisation potential of Max. In 1989 Intelligent Music, of which Zicarelli was president at the time, signed an agreement with IRCAM to publish Max. The major change in focus from program to product came with the modification of the Max scheduler, so that the program could play music whilst the user was directly communicating with the interface. This decision by Zicarelli was a direct outcome of his previous experience in designing ‘M’ and ‘Jam Factory’ for Intelligent Music. Additional improvements included “improved screen graphics, playback of standard MIDI files, multimedia capabilities, and a large collection of new features.”\textsuperscript{169}

\textsuperscript{167} For further information see: [http://www.macromedia.com/software/director](http://www.macromedia.com/software/director).
\textsuperscript{168} Puckette 31.
The potential of Max, as described by Zicarelli, is that the program provides, "relatively easy-to-use, high-level, and efficient access to writing software." Rowe further suggests that, “other languages are available, but the documentation, ease of use, and focused optimisation of Max for building [interactive computer music] systems are compelling recommendations indeed.” The commercial version of Max was released in 1991 and has been continuously upgraded.

Max/MSP is a graphical programming language whereby ‘objects’ pass messages to one another that invoke some method within the object receiving the message (Figure 10.). Additional arguments can be assigned to an object, and a number of objects interconnected (called a ‘patch’) can be nested within a larger object array. ‘Monitor’ objects are often placed within the signal path to “inspect the input or output from other objects; tables and histograms can easily be added to store or display data.”

Fig. 10. An Example of Two separate Max ‘Patches’ with Appended Information Describing the Function of Respective Objects Within the Patch

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171 Rowe 27.
The MaxStage Environment

The MaxStage environment (Figure 11.) is comprised of five modules that can be positioned in any configuration on the screen by the user. The five modules are

- The Stage
- Theatre Interface 1.3.
- The Trigger Palette
- The QuickTime™ (QT) Movie Window
- The Instructions

Fig. 11. Overview of The MaxStage Environment
The Stage

The background graphic is a birds-eye view of an intended proscenium arch, stage design for *Rebecca - The Musical*. The set design includes two trucks connected at right angles; the higher-level truck positioned stage left. Access to the stage right truck is via a descending four-level stair. A cyclorama upstage of the trucks is used for back projections.

In the current version of The MaxStage, the only way to indicate changes of set or properties on the background graphic is by drawing objects onto the graphic in an appropriate graphics program, such as Photoshop CS. The updated graphic is then replaced in the Theatre Interface 1.3 folder. In subsequent versions, calling up different scenes will also call up the appropriate stage graphic as intended.

The Theatre Interface 1.3.

![Theatre Interface 1.3](image)

Fig. 12. The MaxStage Theatre Interface 1.3. Module

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173 In The MaxStage folder, on the accompanying CD, this graphic is labelled - stagebig.pct.
A maximum of ten scenes can be recorded for subsequent recall (Figure 12.). Scenes are selected from the drop-down menu in the top right corner of the Theatre Interface 1.3. module. New scenes may be selected in Playback mode as well as in Stop mode. Only actor movements are stored within scenes in the current version of The MaxStage. Sensor-zone placements, MIDI files and QT movies have to be set manually for each scene as needed. Whereas this may appear to be a limitation, greater flexibility in auditioning different trigger placements and alternate MIDI files can be accomplished without having to re-map predisposed actor movements.

Individual actors are enabled by clicking on 1, 2 or 3; or alternatively, by selecting buttons A1, A2 or A3. Each actor is indicated by a coloured circle: A1 (Yellow), A2 (Blue) and A3 (Green). Up to three actors can be represented simultaneously in this version of The MaxStage.

To permanently remove an actor off the stage, re-select that actor and move the mouse in any direction.

**Recording**

Once the cursor position (via mouse position) is located on the stage at the appropriate starting point (actor location start point), recording of actor movement is initiated by pressing the spacebar. The user then drags the actor icon around the stage determined by the stage blocking as prescribed by the Director. Recording stops when the spacebar is pressed again. Rerecording overrides the previous record attempt. The last recorded actor movement is held in memory.

Smoothness of actor movement is determined by the fluidity of mouse movement by the operator. Greater accuracy of actor movement may be achieved by using a peripheral graphics tablet and stylus.
Playback

Playback of respective actor movement is enabled by clicking shift-1, shift-2 or shift-3; or alternatively by selecting playback buttons A1, A2 or A3. To commence playback of actor movement, press ‘P’. Pressing P at any point during playback stops the playback at that point. Pressing P again, continues the playback from that point. Playback can be reset to the start of the sequence by pressing ‘O’. Playback status is indicated by an ‘X’ appearing in the Play/Stop window.

Timeline Bar and Counter

In both Record and Playback modes, the timeline bar and counter show the relevant point in the sequence. The timeline bar can be moved manually in Stop mode. Playback will subsequently commence from this point, if required. Sequences, however, can only be recorded from a start time of 0.000 seconds.

The “[“ key will scrub the timeline backwards and the “]” key scrubs the timeline forward. These key functions can be used in both Stop mode and Playback mode. It is not advisable to move the timeline bar with the mouse in Playback mode: this mode of moving forward or backward through a scene only consistently works approximately 80% in this version of the software.

MIDI Controls

There are four options in the MIDI controls window: select MIDI file, Play MIDI, Stop MIDI and Mute MIDI file.

QuickTime Controls

There are five options in the QuickTime (QT) window: select QT movie, Play QT, Stop QT, Mute QT and Purge QT (to free up processor memory).
The instruction dialog box can also be opened from a button in this window, if it has been previously closed for any reason. Max sub-patches for trigger zones, palette options, actor profiles, and playback, MIDI and QT movie elements can be unlocked in The MaxStage environment for editing purposes and easy access to parameter changes by pressing ⌘-E.

The Trigger Palette

![The Trigger Palette Module](image)

Fig. 13. The MaxStage Trigger Palette Module

There is a choice of four sensor-zones available from the palette module (Figure 13.). Each sensor-zone is a virtual representation of physical sensor-based system designed to identify movement within a fixed boundary.

Types of commonly used physical sensors include:
• **Triggers**

A trigger is a simple on or off switch that is either pressed (i.e., a floor-trigger security mat), struck, or detects sympathetic vibration of an object that is struck (i.e., a piezo-electric pick-up).

• **Distance sensors**

A distance sensor functions by emitting an ultrasonic frequency that bounces back from the object at which it is aimed. A distance-sensor is restricted to use over a limited distance. At low audio levels, a clicking sound emitted by the sensor may be perceptible.

• **Laser (or infra-red) sensors**

An infra-red sensor is a simple light transmitter and receiver. It is activated when the infra-red beam is interrupted (i.e., an on and off state).

• **Accelerometers**

An accelerometer measures the rate of acceleration of the object to which it is attached on either one or two axis. Influenced by gravitational force, they may also be used as ‘tilt’ sensors. They are usually rate at either 1G (Gravity/Force ratio), 5G’s or 10G’s depending on the application.

• **Gyrosopes**

A type of tilt sensor.

• **Flex sensors**

Patented by Abrams-Gentile Entertainment, there are at least six types of flex sensors. The best-known commercial application of a flex sensor was the Mattel/Nintendo Power Glove created in the 1980s. They measure flexure in any joint (i.e., fingers, elbows, knees or
shoulders). They have limited durability and their effectiveness is dependent on the degree of force exerted as a measure of flexure.

- EMG (Electromyographic) sensors
  EMG’s are primarily used in the field of medicine to monitor progress of recovery in muscle rehabilitation. EMG’s can be used to capture the intensity (tension and relaxation) of specific muscle groups. Feedback is a variable signal.

- Electro-magnetic field sensors
  The best-known example of an electro-magnetic field sensor is the Theremin. Employing an antenna, it can measure minute changes in direction very accurately. It is not as directional as an ultrasonic (distance) sensor.

- Squish sensors
  A squish sensor is a semi-conductive pad/foam that measures variation in resistance as a function of applied pressure.

Sensor-zones in The MaxStage are placed on the stage by clicking and dragging from the square boxes. The size of any sensor-zone is scaleable by increasing the respective slider value on the right-hand side in the palette module. Each trigger is separately colour coded. When an actor ‘collides’ with a sensor zone, a separate ‘collision’ detected LED will be activated. If an actor moves quickly into and then out of a sensor zone, there may be no visual confirmation, dependent upon the processor speed of the user’s computer. Irrespective of this, the MIDI file will be triggered. The Max/MSP software places a higher priority on audio events than it does graphic events.

A separate MIDI file can be selected for triggering, when an actor crosses into a zone bounded by any of the four triggers. MIDI files for each trigger (sensor-zone) are selected via the respective ‘read’ buttons. The designated
auditory aura is designed to continue only whilst the actor remains inside the boundary of the zone entered (dependent on the actual duration of the MIDI information or audio file). Multiple MIDI files can be triggered sequentially irrespective of whether other MIDI files are still playing.

In the current version of The MaxStage, trigger location on the stage is not captured in the scene information. Triggers must be set into the correct position at the beginning of each session.

To delete a trigger on the stage, click on it and press delete. The ‘Trigger Reset’ button is used if two triggers are accidentally placed on top of one another. Triggers, however, can be placed within each other to create multi-zone frames (Figure 14.).

![Figure 14. A multi-zone frame consisting of four separate zones. Upon actor collision, four different MIDI or audio files will be triggered in this configuration.](image)

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174 In the current version of The MaxStage (Ver. 1.3), a separate note-off event is not sent when the actor leaves the boundary of the zone entered. Consequently, if the actor moves out of the sensor-zone frame and then re-enters, the MIDI file is re-triggered.
The QuickTime Movie Window

Fig. 15. The MaxStage QuickTime Movie Window

The QT Movie Window (Figure 14.) is incorporated into The MaxStage environment to show an audience view of the stage and associated actor movement within the stage space. Alternatively, it can be used to show back-projections or any other pertinent visual information.

Sound design examples from Rebecca - The Musical, on the accompanying CD-ROM QT include movie excerpts from a concert version of the Musical. The soundtrack of the concert is embedded within the QT file. The soundtrack includes all spoken and sung text, the orchestra and sound effects (both diegetic and non-diegetic sounds).
CHAPTER SIX

Plotting the Sound Design in Rebecca - The Musical

The MaxStage is the platform on which sound design objects are tested and subsequently iterated. However, it does not predetermine where additional auditory aura may be placed within the ongoing narrative context. Similarly, the System Model defines only potential temporal characteristics of additional auditory aura and how sonic objects may be articulated through a space-time corridor.

A method for plotting sound design in the theatre has been described by Bracewell.\textsuperscript{175} His ‘Tension Curves’, as a visual summary of the dramatic architecture of the play, is an effective methodology for gaining overall structure of the dramatic elements within a prescribed section (notably each Act of a play). Whereas Bracewell defines ‘tension’ as a simple indexical scale (from zero to one-hundred per cent) film sound-designer, David Sonnenschein, perceives changes in tension as “the flow of drama [that] leads us to turning points in the story that evoke shifts in physical space, intent, emotion, and in general a new direction for the characters and plot.”\textsuperscript{176}

Given as examples of bipolar extremes (i.e., harmony-dissonance; friendly-menacing) he suggests that physical or dramatic transitions, as identifiable markers of tension, should be based on “an analysis of the arcs and dramatic turning points of the characters and plot, consciously emphasizing, suggesting, or even contradicting what is occurring in the subtext of the script.”\textsuperscript{177}

The Tension Curves developed for Rebecca - The Musical are an amalgam of both Bracewell and Sonnenschein’s exemplars.

\textsuperscript{175} Bracewell 224-27.
\textsuperscript{177} Sonnenschein 10.
Four symbolic arcs are identified to function as transitional marker-points in the narrative tension of the plot. These markers become useful in identifying potential locations at which extended sound design possibilities can be overlayed onto the theatrical score.

In turn, the psychological and symbolic signification of the main protagonists needs to be considered. As well as being useful contextual information, an evaluation of how each character responds and relates to the transition markers is necessary to establish overall dramatic coherency in the design of potential audio aura.

**Symbolic References and Their Evocation**

The psychological and symbolic sub-textual references that underpin the dramatic structure in *Rebecca - The Musical* are most clearly delineated at points that evoke shifts in physical space, heightened emotions, and contradicting behaviours by characters. These transitions are significant marker-points in the exposition of plot and character development.

Revolving around the four main protagonists: Maxim de Winter and the ‘new’ Mrs. De Winter; Mrs. Danvers and the ghost-of-Rebecca, the four symbolic arcs are

1. Power – Weakness
2. Security – Insecurity
3. Possession – Dispossession
4. Life – Death

At specific transitional points, percipients of *Rebecca - The Musical* are sonically thrown into a world of raw emotion which is at times uncertain, confrontational, unsettling and decidedly uncomfortable. The design of auditory stimuli at these turning points attempt to conform to Georg Wilhelm Friedrich Hegel’s theory [cited by Carl Dahlhaus] that, “audible things are sensed not as things out there, but rather as events surrounding us
and invading us, instead of keeping their distance from us.”¹⁷⁸ Similarly, Dahlhaus describes this experience as “tones, understood as stimuli in a physiological-psychological sense, [that] release reflexes; they stimulate feelings that a listener does not objectify but rather feels immediately as his own, as invasions of his heart.”¹⁷⁹

These transitional points, according to Dermot Rattigan, can be divided into two possibilities: informing either an aspect of character or of a specific event in the plot line.¹⁸⁰

Table 3. Conditions Underpinning Symbolic Reference at Transitional Points in Dramatic Exposition.

<table>
<thead>
<tr>
<th>CHARACTER</th>
<th>EVENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psychological (subjective)</td>
<td>Sensory Perception</td>
</tr>
<tr>
<td>Physiological condition</td>
<td>Mood / Tension</td>
</tr>
<tr>
<td>Physical presence</td>
<td>Foretelling</td>
</tr>
<tr>
<td>Object (physical)</td>
<td>Object (sensed)</td>
</tr>
<tr>
<td>Emotions</td>
<td>Background / Place</td>
</tr>
</tbody>
</table>

Although Rattigan’s idea is predicated on the qualified use of music in radiophonic drama, it is equally useful in the consideration of the function of sound design in any medium. More than one symbolic reference may be applicable at any given instance.

For example, in Cue 31c (“Final Confrontation”) in Rebecca - The Musical; the only instance of direct present-time dialogue between Maxim De Winter and Rebecca (as a semblance of her character in life), the event is marked by a perceived heightening in sensory perception. Treated as a direct sign, the appearance Rebecca establishes an immediate and compelling increase in dramatic tension and a foretelling of the future. Additional sound design at

¹⁷⁹ Dahlhaus 19.
this point in the dramatic narrative should fulfil dramatic requirements of both ‘character’ and ‘event’ in Rattigan’s terms.

**Concept of Characters**

As previously noted, maintaining clarity of the dramatic qualities and flaws of each of du Maurier’s characters in *Rebecca - The Musical* is essential, so that designed auditory stimuli do not contradict the dramatic intention of the narrative. Nina Auerbach, argues that du Maurier’s male characters are “her most distinctive achievement, but they are also her most unsavoury. All her leading men are, in her (du Maurier) words, ‘underdeveloped [and] inadequate.” So too, Maxim de Winter is dependable but ultimately flawed.

The ‘new’ Mrs. De Winter progresses from a young ingenuous bride to a woman whose resilience and unerring sense of ‘goodness’ is only peripherally immured by force of adopting the ghost-of-Rebecca’s own tactics to ensure her and her husband’s survival. For Mrs. De Winter danger lies, as Auerbach suggests, “not in muffled vision but in seeing too much. *Rebecca*’s true fog is within, shrouding motives, not objects.”

Rebecca’s influence and presence hangs like a shroud over the new Mrs. De Winter at Manderley. Unlike the character of Rebecca, only ephemerally sensed in du Maurier’s setting, the ghost-of-Rebecca in the musical adaptation is a personage who portends unadulterated evil and malevolence on every level and at every turn. This point of difference in the treatment of the Rebecca character in the Musical prompted her evocation through sound design auditory aura.

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182 Auerbach 135.
183 Rebecca, as a personage, is neither seen in the 1940 film adaptation directed by Alfred Hitchcock, nor in the 1997 Television adaptation, starring Charles Dance, Emilia Foxe and Dame Diana Rigg (as Mrs. Danvers). I have not been able to view the 1947, 1962 or 1979 adaptations to verify whether this treatment of the character of ‘Rebecca’ is consistently handled in this manner.
The character of the sinister housekeeper, Mrs. Danvers, is in many respects the central unifying influence on all that happens at Manderley. In the Musical, Mrs. Danvers connivance and irrationality is not inherently evil; rather, her truculence is conveyed through a sense of her dispossess at Manderley and her self-perceived loss of relevance at Maxim’s Cornwall Estate.
The Tension Curves

Fig. 16. Tension Curve for Act I of *Rebecca - The Musical*
Act I Tension Plot

The six dramatic transitional points in Act I occur as follows:

1. Cue 3: Manderley

2. Cue 10: Sleep Well My Princess

3. Cue 11: the concluding section (bars 83-87 inc.) - “Until the End of Time”

4. Cue 16: - the middle section (bars 60-78 inc.) - “Rebecca”

5. Cue 17: - the concluding section (bars 59-79 inc.) - “In Your Shadow”

6. Cue 21: - (bars 1-4 inc.) - “Until the End of Time” (Playoff)

Three of these transitional points (cues 10 and 16) coincide with dramatic increases in tension with the musical score. By contrast, cues 11 and 17 coincide with points of decreasing musical tension. Cue 21 similarly involves only score fragments punctuating Maxim’s consternation with Mrs. De Winter’s costume at the Manderley Ball.

Cue 3 is a different case: “Manderley” segues from cue 1 - “Neptune’s Bride” (Overture) and is an extension of the musical dialectic established in the orchestral opening.
Fig. 17. Tension Curve for Act II of *Rebecca - The Musical*
Act II Tension Plot

The four dramatic transitional points in Act II occur as follows:

1. Cue 28: the middle section (bars 78-82) - “I Need To Know”

2. Cue 29: ‘The Evidence” (Part 1)

3. Cue 31c: the concluding section (bars 59-63 inc.) - “Final Confrontation”

4. Cue 33: the concluding section (bar 121 leading to cue 34) - “Dreams” / “Manderley” (Reprise)

The middle section of cue 28 marks the point of realisation for Mrs. De Winter of how Rebecca actually died. This moment-of-truth is punctuated by extended stage silence: Maxim De Winter has lied. Mrs. De Winter’s sudden realisation of her husband’s fallibility brings the menace of the ghost-of-Rebecca inexorably closer.

Cue 31c deals with Maxim’s ultimate ‘redemption’. This cue is an extended underscoring scene in which Maxim De Winter finally rejects the continuing shadow of Rebecca’s presence in his life. The concluding section of this cue also coincides with Mrs. Danver’s departure from Manderley.

Cue 29 - The Evidence (Part 1) - marks the beginning of the dramatic denouement. The scale of dramatic tension begins to slowly rise not because the audience is unaware of how Rebecca died but because the protagonists’ inherent human frailties and potential to act outside of their motivation (as perceived by the audience) are brought into sharper focus.

The concluding section of the Musical (cue 33) foreshadows the imminent demise of Manderley.
It is evident that dramatic transition points are neither solely determined by moments of intense musical activity, nor by dialogue-only sections with heightened tension. Transitions that pre-empt scene changes, with or without a corresponding shift in time or place, and that require the emotional states of characters being held over, delineate potential points of active sound design. Additionally, where the narrative initiates a memory sequence; either internalised by a character or expressed through onstage flashback, portends impending disaster or intends an unseen influence, there is similar potential for overlayed auditory aura.

Cast in a cinematic medium, this same potential will, admittedly, often be heard as a sound effect; conditional upon a reflexive listening relationship and consistent with directing the audience’s POV. Where, however, a synergetic relationship between creative sound design and accompanying film action / narrative occurs, the possibilities available to transcend a one-dimensional interpretation is proportionally enhanced. Whereas, this is the current challenge confronting the interactive game industry, the potential to transcend one-dimensionality in sound design in the theatre remains underdeveloped.

Two examples; one from each Act and taken from the list of transition points above, demonstrate how auditory aura are conceived as part of an overall sound design plot for Rebecca - The Musical. Stored as Scene 1 and Scene 2 respectively, in The MaxStage application on the accompanying CD-ROM, they are

1. Cue 11: the concluding section (bars 83-87 inc.) - “Until the End of Time”
And

2. Cue 28: the middle section (bars 78-82) - “I Need To Know”

A detailed explanation of how the sound design objects were conceived, as derived from the System Model, is presented in the following chapter.
Reading the System Model

Having articulated both the potential function and probable placement of sound design objects in *Rebecca - The Musical*, we can now turn our attention to defining the properties of auditory aura in terms of their indexical or symbolic content. As stated in the Introduction, this thesis is not primarily concerned with the domain of sound effects. Consequently, no sounds created as auditory objects in *Rebecca - The Musical* are iconic in function.

The System Model (Figure 18.) is the final distillation of all the elements considered up to this point in the discussion. It is, ostensibly, a map articulating not only the function of an overall conceptual sound design but also a process for the design sequence of auditory aura.
The System Model is read from top to bottom and from left to right. Laurel’s iteration of Aristotle’s six qualitative elements of structure in drama, and their contextual corollary in the design of The MaxStage environment, are the overarching constructs in this meta-representational diagram. Each element, as previously described, is the formal cause of all those below it; and each element, is the material cause of all those above it. This two-way organizational structure is consistent across all modules in the system design, irrespective of the direction from which they are viewed.

Implicit, also, within this two-way structure is the proposed theoretical machine learning protocols to be implemented in a physical interactive computer music system. Entry points within the process chain for evaluating the efficacy of auditory objects as they are designed are clearly marked at both the mapping and processing stages.

The following steps should be taken to derive the constructs of any intended sound design object

1. Establish whether the POV for a character’s predisposition toward action, or a pre-enactment of thought leading towards action (or non-action) is based on a direct sign or on an external signifying influence. This decision relates directly to the design of real-time signal processing algorithms in a physical system and the subsequent deployment of sensor-based technologies within a specified zone.

For example, if the auditory object functions to explicate the meaning of a sign (in semiotic terms), the processing algorithm may be conceived as one that increases frequency, variations in timbral spectrality and intensity (volume) as a character moves increasingly closer to the imagined source of sound. Conversely, if the auditory object functions to indicate a signifying influence, the ICMS may be disposed toward changes in sonic duration, alterations in the envelope of sounds and qualification of the directionality of those sounds.
2. Establish the relational mode of listening intended toward the sign or signifier. If the relationship is indicative, where direct causality of the sound is intended, then the sound is likely to be either a sonic metaphor, or sonically iconic and treated as a specific spot effect. If an interactive listening relationship is intended, the design of the sound must be treated in the context of where it is positioned in relation to any simultaneous dialogue or event(s) in the musical score. This is particularly important in the application of sonic simile, where a rhetorical code suggests an association between two contrasting contexts (i.e., different time-space corridors, or simultaneity of events occurring in different places.)

Foregrounding the auditory object will result in a distinct shift in dramatic focus, contingent upon its level of surrogacy. The level of surrogacy is inversely proportional to the potential shift in dramatic focus that may occur. With an auditory object of extended duration, it may be necessary to change both its perspective placement in the overall field and level of surrogacy over time. Neither of these two factors should be considered independently. Each factor influences the other. Therefore, both surrogacy and sound perspective are, to an extent, interchangeable in position in the System Model diagram.

3. Establish whether the sound involves movement, either by an object, or by an actor. If the sound has kinesic properties, consideration should be given to including a measured, or rhythmic component to the auditory object. Conversely, if the sound is proxemic in nature, then consideration should be given to eliminating any sense of measured time associated with the auditory object.
The System Model and a Physical ICMS

In a completely integrated physical ICMS, the size of the sensor-zone area specified for an auditory object intending, for example, ‘kinesic’ properties, would be determined by the number of adaptive-audio modules considered appropriate for that space, the importance of the signifying object and the narrative duration. This would be determined in advance by the importance of the signifying object and the length of time the actor is to remain within the boundaries of the sensor zone. A smaller area on the stage would likely suggest the creation of fewer adaptive-audio modules than would a larger stage area.

Similarly, auditory objects with ‘proxemic’ properties may be circumscribed by a proportionally larger area of the stage, but may have correspondingly fewer adaptive-audio modules if the sound is conceived as being unmeasured or lacking an identifiable rhythmic content.

For example, Figure 19, represents a moderately large sensor-zone stage area: with up to thirty-two selectable adaptive-audio modules, dependent on the positional movement of the actor(s) within the zone and the corresponding degree of foot pressure applied by the actor(s). The material cause of how any adaptive-audio module responds is a function of the mapping algorithms designed in the ICMS (as explained in Chapter Three).
Fig. 19. A medium-large sensor zone: each interstice configured by the relevant placement of pressure sensitive mats. Each mat can trigger either one of two adaptive-audio modules, dependent upon pressure applied to the mat. If the infra-red sensors circumscribing the area bounded by the pressure sensitive mats are deactivated, the stage area reverts to an inactive default state.

With a methodology for describing the function of sound design and having established a model for the design sequence articulating that function, we turn our attention to specific examples in Rebecca - The Musical.
CHAPTER SEVEN

Analysis of Sound Design Examples in Rebecca - The Musical

Two sound design examples are discussed in this chapter; one from each Act of Rebecca - The Musical. Both examples are extracted from one of the discrete transitional points as identified in the preceding chapter.

The appropriate sound files can be loaded into The MaxStage application on the accompanying CD-ROM, having previously loaded the MaxStage_VSamp_inst file into the VSamp application.¹⁸⁴

Act I Sound Design Example

The first example (Example 1.) created to test the efficacy of the System Model, is taken from Act I, cue 11: the concluding section of “Until the End of Time”. This corresponds to the previously identified transitional point No. 3. (p. 99).

¹⁸⁴ Whereas VSamp will operate on both OS9.x and OSX.x.x operating systems, it is assumed that OSX 3.7 or later is installed as the Apple operating system. Please refer to the Foreword in Volume I to review the instructions.

Performed by Maxim de Winter and the Young Companion, the designed auditory aura appears, approximately, on beat three of bar 82 and continues through to, approximately, the end of bar 87.

Set in the Dining Room of the Princesse Hotel - Monte Carlo, Maxim: at the beginning of bar 83, feels, “…the cold wind of the dead”.*185* He has, immediately prior, asked for the Young Companion’s hand in marriage. Maxim’s response (POV); unexpected by the Young Companion and

audience alike, is the first visibly perceived pre-enactment of his internal struggle with having murdered Rebecca. This POV is made evident by the signifying influence of the ghost-of-Rebecca, as she enters and draws enticingly near to Maxim.

For this example, the basic quality of the designed auditory aura was conceived to foreground the sign (the ghost-of-Rebecca); inferring both her immediate sepulchral presence and a foreboding of the consequences of Maxim’s decision to re-marry. On another level, this sonic object also portends the impending difficulties the Young Companion will face (as the ingenuous ‘new’ wife) in a social milieu she is ill-equipped to handle.

The initial sound source was taken from an Ensoniq ‘FIZMO’ synthesizer.\(^{186}\) The ability to design auditory aura, however, is not dependent upon the availability of any specific hardware MIDI synthesizer or software-based synthesizer. The sound source could have been derived from a real-world sound with the appropriate spectral qualities. In practice, it is likely that a number of different sounds, from varying sources, would be considered for inclusion. The timbral quality of the initial sound can be defined as possessing characteristics of a complex string vibration with minimal amplitude modulation and an envelope with a slow attack and decay.

The exact duration of the sonic object is indeterminate; the start and end of the sound being a function of the size and displacement of the sensor zone, and the speed at which the ghost-of-Rebecca circumscribes the assigned stage-blocking in The MaxStage. Both these factors are variable, however, once the actor movement and sensor zone configuration has been configured as a MaxStage scene. For example: either, the actor movement is re-recorded, to be either faster or slower over a portion of the movement as tracked or, alternatively, the size and displacement of the sensor zone is changed when the actor movement is unchangeable (as decided by the director).

\(^{186}\) The Ensoniq FIZMO synthesizer does not give patch-names to sounds. Provided with only a limited LCD display, the keyboard designates sounds as patch numbers only. In this case, factory preset 07 was used.
In this example, the auditory object functions primarily to explicate the meaning of a sign. The processing algorithm, in this case, (as part of a physical ICMS) would be designed to change the timbral spectrality of the sound source as the ghost-of-Rebecca moves closer to the point of action. As the ghost-of-Rebecca’s influence is not fully realised at this point in the exposition of the play, other potential changes in sound intensity (volume) or fluctuations in frequency - consistent with a direct POV - would be held in abeyance. As has been previously observed: sound design, initiated to underpin dramatic coherency, should not contradict the intended level of dramatic tension.

Auditory aura, as a semiotic indication of the ghost-of-Rebecca’s presence, suggests an interactive relational mode of listening. Whereas, a dramatic device suggesting a ‘ghost’ as part of a sound design would traditionally be treated at an indicative relationship level (or even as an iconic spot effect) this solution suggests a one-dimensional treatment of character inconsistent within the context of Rebecca - The Musical.

As a function of this interactive relationship, the ghost-of-Rebecca was determined as requiring a total loss of connection - a remote surrogacy. The remoteness of the sound also necessitated, in this instance, that the sound object remain fixed in the background; a dramatic shift in focus away from the continuing narrative of the two protagonists being inappropriate. As a starting point, to achieve this remote level of surrogacy, the initial sound source was lowered by one octave and its duration doubled. Figure 20. shows the resulting audio track, created in Pro Tools, from the initial MIDI synthesis source.
Fig. 20. Pro Tools Screen, displaying the stereo audio track (Audio 1 - green) created from the original MIDI track (MIDI 1 - red). The upper two tracks (calrec.1 and calrec r.) are the stereo audio tracks from the performance of *Rebecca - The Musical*. The Serato “Pitch’n Time” plug-in (overlayed on the right-side of the screen) highlights the alteration to the original MIDI note information - D2 and C#3: time stretched by 50 per cent and lowered in pitch by 12 semitones. The resultant output is double the original MIDI note durations, and sounds one octave lower. Audio 1, has then been shifted slightly backwards in the time-line, and the tail of the sound trimmed and faded out.

Two other defining attributes for a sonic object signifying the ghost-of-Rebecca were considered, within the constructs of the System Model: the sound time/rhythm characteristics of the sound, and whether the sound reflected proxemic or kinesic properties. In this example, it was determined that the designed sound object would suggest unmeasured time and envelop space, without any clearly articulated movement.

Additionally, some sense of flashback - characteristic of an emotional memory - would further invest the sound object with a particular relevance for Maxim De Winter. This needed to be executed without the resulting auditory aura itself becoming self-referential, or iconic, in function. This could be further described as a form of ‘reverse sonic simile’.
To achieve this sonic image, the sound object (as modified) was reversed, then subsequently treated with both delay and reverberation. Figures 21., 22. and 23., respectively show the effect processing order for this stage of signal-processing in Example 1.

Fig. 21. Pro Tools screen, displaying the modified sound source, reversed in direction, through the inbuilt Digidesign plug-in
Fig. 22. Pro Tool screen, displaying the relevant delay settings applied to the modified sound source through the DIGIRACK MOD DELAY II plug-in. The delay setting is 678 milliseconds. The resulting output is contained within an auxiliary track (Aux 1).
Fig. 23. Pro Tools screen, displaying the RTAS plug-in setting for digital reverberation. The MIX level is set at 100% with frequencies above 15.1 KHz cut at 87% diffusion. This results in a sound with wide spatial disbursement in a large virtual domain. This sound is post-reverse and post-delay settings.

Finally, as a metaphor for the ghost-of-Rebecca’s presence as an emotional memory, the sound object (as modified up to this point) was deleted, leaving only the reverberation tail of the reversed sound source. This remaining portion of the sound was, in turn, treated with the Serato “Pitch ’n Time” plug-in effecting a gradual rise (glissando) in pitch of one semitone over the length of the sound (Figure 24.). This process offset any psycho-acoustic pitch relationship to the prevailing harmonic content of the score.
Act II Sound Design Example

The second example (Example 2.) is taken from Act II, cue 28: the middle section of “I Need To Know”. This corresponds to transitional point No. 1, as previously identified (p. 101).

Performed by Maxim and the ‘new’ Mrs. De Winter, the designed auditory aura begins at a point immediately following Mrs. De Winter’s line, “…all those things were in the past” delivered over the fermata in bar 78. The auditory cue fades out at some indeterminate point, over the fermata, in bar 82 [TACET]. The length of the auditory cue is determined solely by the duration of the dialogue; the score repeating a one-bar phrase between bars 79 and 81.

As with the previous example, the imprecise nature of the sonic object’s duration is similar to the process of creating transition matrices within adaptive-audio engines for interactive computer games. As the *mise en scène* changes, the impact of the auditory aura seamlessly integrates into the new scene, irrespective of when it occurs. The fact that the duration of the created

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188 The one-bar phrase, repeated between bars 79 and 81, is notated three times for visual reference only - a convention commonly found in musical-theatre scores. The three-bar phrase, in this context, further reduces the tendency to accent the downbeat of each bar.
sound object is, more or less, under the control of the stage actors - and not the sound department - represents a significant shift in theatrical practice.

Set in the Boat-House at Manderley, Maxim, bereft in his recollections of how insidious his life with Rebecca was, has finally conceded the truth of his former existence to his new wife. This precipitous moment coincides with three, distinct points-of-view. For the ‘new’ Mrs. De Winter, the revelation that Maxim has never loved Rebecca, is abruptly overshadowed in the knowledge that her husband is responsible for his former wife’s death: for Maxim there are the serious implications in having revealed the truth, so long concealed; and, for the ghost-of-Rebecca, there is a sudden loss of security established (a dramatic volte-face) in no longer being perceived as a rival for Maxim’s love. Rather than extract three separate sound design objects, it was determined that one complex object could delineate the three protagonists’ individual emotional states.

The sound source, as for Example 1., was originally extracted from an Ensoniq ‘FIZMO’ synthesizer. In this example, however, the sound’s resonance level and band-pass cut-off frequency were manually swept during re-recording into Pro Tools. This initial alteration provided basic changes in frequency to the sound, whilst constantly varying the prominence of certain frequencies arbitrarily over time. To offset any psycho-acoustic pitch relationship with the prevailing harmonic content of the score, the sound object was filtered through the ‘Amplitube’ plug-in. The ‘Mani Wah funk’ setting (with a small delay and mid-level distortion) effectively modulated the basic frequency content of the original sound source (Figure 25.).

189 Factory preset 35 in the FIZMO synthesizer described a sound with spectral qualities consistent with an intended result adapted and modified within Pro Tools.
Fig. 25. Pro Tools screen, displaying the original sound source from the Ensoniq FIZMO synthesizer, re-recorded into Pro Tools and filtered through the ‘Mani Wah funk’ setting in the ‘Amplitube’ plug-in

The resulting sound is highly unstable in terms of pitch. The spectral quality of the sound appears to constantly evolve and change. The frequency modulation parameters affecting the sound object provide a rise-and-fall effect consistent with the notated score. Dramatic coherency is further strengthened because the ever-shifting, ethereal nature of the sound object (due to shifts in frequency) does not conflict with the frequency range of the concurrent dialogue. Similarly, the rise-and-fall effect provides an unsettling reminder of the ghost-of-Rebecca’s association with the sea; a device that underpins the entire musical fabric of Rebecca - The Musical. At the point where the band-pass filter blocks all but the highest frequency overtones, the ‘wah’ amplitude modulation effect is at its most noticeable. These sonic moments are designed to reinforce the semiotic considerations of extreme emotional uncertainty (in the case of the ‘new’ Mrs. De Winter) and extreme emotional resignation (in the case of Maxim De Winter).

As part of a physical ICMS, Example 2., predisposes thoughts that are objective (signified) rather than directly attributable to a sign - as was the case in Example 1. The signifying influence in Example 2., is the
manifestation of truth as a consequence of actions that have preceded it. The ICMS, in this context, would be predisposed toward changes in the envelope of the auditory object, with associated random changes in directionality of the sound.

As was the case with Example 1., a remote level of surrogacy was determined appropriate. The sound perspective would be placed somewhere between the middle-ground and foreground. However, the sound time/rhythm and proxemic/kinesic property considerations for Example 2., were more complicated. In many respects, the sound object tended to a duality of characteristics: measured time for the living and unmeasured time representing the ghost-of-Rebecca’s eternity. Similarly, the truth of Rebecca’s demise tended to invoke movement (as a response mechanism), whereas the ghost-of-Rebecca always invokes space. Ultimately, a decision to impose a sense of temporal time, considerably slower than actions revealed in real-time, was made to counteract the partly-measured and kinesic property of the sound object (as modified to this point). To effect this, the delay and reverberation settings from Example 1. were recalled and applied to the sound (see Fig. 22. and Fig. 23.). These settings assisted positioning the sepulchral presence of the ghost-of-Rebecca into the sound object frame. Finally, the sound object was treated in the DIGIRACK TIME COMPRESSION/EXPANSION plug-in and slowed down by a factor of four, without changing the original frequency settings. The resulting sound is a metaphor for time appearing to go perceptibly slower, or ‘stand still’, in moments of crisis (Figure 26.).
The foregoing discussion highlights the overall intensity of the design process and the length of time required to both create the requisite number of sonic objects in a large-scale project and to map them consistently to the prescribed dramatic context. Adhering to the System Model provides a reliable and sequentially ordered mechanism to develop appropriate sound design representations. Once developed, whether as a single sonic object or as a number of alternative objects, all sound design representations may be easily incorporated into The MaxStage environment for subsequent discussion by the creative team.

The final step to use the created sonic objects as auditory aura within The MaxStage virtual environment involves simply extracting the saved Pro Tools files into VSamp in the Audio Interchange File Format (AIFF).
samples are then set to trigger, via a specified MIDI note number as MIDI files from The MaxStage, as required (Figure 27.).

Fig. 27. VSamp screen, displaying both loaded sound design examples as created. Sound Design Example 1. is set to be triggered via MIDI note 60 (C4) and Sound Design Example 2. via MIDI note 48 (C3)

Recalling the Stored Examples and Setting the Sensor-Zone Frames

Scene 1:
Actor Movements stored in Scene 1 in the Theatre Interface 1.3 module correspond to music Example 1. (p. 110). The associated QT movie file for this example is Rebecca-qt320.mov. To load this movie file, click on ‘Select

190 The MIDI note numbers are pre-set within the MIDI [.mid] files. The note-on velocity settings are set within VSamp. The velocity values have been set so that the auditory aura and the soundtrack, as embedded within the individual QT movie, are balanced. However, the relative balance between the soundtrack and the sound design objects can be changed via the LEVEL window (Far right column).
QT Movie’ in the ‘Theatre Interface 1.3’ module and choose it from the drop-down menu. The file is located within the Theatre Interface 1.3 folder.

To select the correct MIDI file for this example click on ‘read’ for trigger 2 (pink) and select the file, ‘Rebecca1.mid’. Alternatively, any trigger number may be used as long as the corresponding sensor-zone is also selected.

To place the sensor-zone frame in the nominally correct position for Scene 1, click and drag the sensor-zone frame onto the Stage module as shown in Figure 28. You will need to use the respective sensor-zone slider in the trigger module to size and position the sensor-zone after it has been placed onto the stage. If placed as shown, the sound design object should commence on, approximately, beat three of bar 82 and continues through to, approximately, the end of bar 87 immediately before the QT movie fades to black.

![Fig. 28. Correct Placement for the Trigger 2 (Red) Sensor-Zone](image)

There is a possibility, in the current version of The MaxStage, that sensor-zone frames may be recalled when specific scenes are selected. This software ‘bug’ was unable to be overcome at the time of writing. Should sensor-zone frames appear on any scene recall, select ‘Trigger Reset’ from the Palette.
module to clear them and reset them manually on the Stage module, as
described.

To recall the actor movements for Scene 1, click on ‘Scene 1’ in the Theatre
Interface 1.3’ module. The default memory setting is the last recalled scene,
which may not be scene 1 even though this is displayed as the default scene
number in this module.

Lastly, to enable individual actor playback for all three actors required in this
example, press shift-1, shift-2 and shift-3, or alternatively, click on A1, A2
and A3 under Step #2 in the ‘Theatre Interface 1.3’ module. In scene 1, actors
A1, A2 and A3 represent the ‘new’ Mrs. De Winter, Maxim De Winter and
the ghost-of-Rebecca respectively.

Pressing ‘P’ will commence playback of the actor movement and the QT
movie file. When the ghost-of-Rebecca enters the sensor-zone frame the
designed auditory aura will be triggered. At this point, The MaxStage
should appear similar to Figure 29. Whereas the stage-blocking is purely
arbitrary, the motivation is for the ghost-of-Rebecca to appear from upstage,
stage-right (behind the dresser) eventually leaving through the open
window. The ‘fly-out’ dramatically presages Mrs. Danvers ominous
intentions later in Scene 9: (Go Now!).
Fig. 29. A Full-Screen of The MaxStage with QT Movie

To stop playback, press ‘P’ again, followed by ‘O’ to reset the timeline counter for actor playback. The QT movie automatically resets on playback stop.

Scene 2:

Actor Movements stored in Scene 2 in the Theatre Interface 1.3 module correspond to music Example 2 (p. 118). The associated QT movie file for this example is Rebecca2.qt320.mov. To load this movie file, click on ‘Select QT Movie’ in the ‘Theatre Interface 1.3’ module and choose it from the drop-down menu. This file is similarly located within the Theatre Interface 1.3 folder.
To select the correct MIDI file for this example click on ‘read’ for trigger 4 (light-blue) and select the file, ‘Rebecca2.mid’. As noted previously, the trigger number chosen is arbitrary as long as the corresponding sensor-zone is selected.

To place the sensor-zone frame in the nominally correct position for Scene 2, (in front of Rebecca’s bedroom window) click and drag the sensor-zone frame onto the Stage module as shown in Figure 30. As for Scene 1, you will need to use the respective sensor-zone slider in the trigger module to size and position the sensor-zone after it has been placed onto the stage. If placed as shown, the sound design object should commence in bar 78 over the fermata and continue to bar 82 [Tacet]. The auditory aura will be heard when the actor icon (representing Rebecca) collides with the sensor-zone frame.

![Fig. 30. Correct Placement for the Trigger 4 (Light-Blue) Sensor-Zone](image-url)
To recall the actor movements for Scene 2, click on ‘Scene 2’ in the Theatre Interface 1.3’ module. As for Scene1, enable individual actor playback for all three actors. In scene 2, actors A1, A2 and A3 again represent the ‘new’ Mrs. De Winter, Maxim De Winter and the ghost-of-Rebecca respectively.

In the arbitrary stage-blocking for Scene 2, Maxim De Winter is initially seated on the Boat-house sofa. The ‘new’ Mrs. De Winter is stage-right of Maxim. The ghost-of-Rebecca’s entry is as for Scene 1 (from off-stage, stage-right behind the dresser). Once entered the sensor-zone frame, the ghost-of-Rebecca duplicates Maxim’s movements. At the end of the auditory-scene cue, she moves downstage left (prompt) and exits the sensor-zone frame.

Pressing ‘P’ will commence playback of the actor movement and the QT movie file for Scene 2. To stop playback, press ‘P’ again, followed by ‘O’ to reset the timeline counter for actor playback.
CONCLUSION

The Future of This Research?

If we were to follow the advice of architectural historian, John Summerson, and “sort out those aging ideas that get encrusted around past creative achievement and clog the proper workings of the imagination in changing times”\textsuperscript{190}, the future of sound design in Musicals would be assured.

This is not, however, a simple proposition given the rapid and changing nature of digital audio. One suggestion, as offered by theatre Sound Designer David Partridge, is that we resist, “falling into the trap of re-executing our previous work on subsequent projects. We need to think freely, to innovate, and to revolutionize the medium.”\textsuperscript{191} Paradoxically, the medium has been revolutionized by advancements in digital technologies and the innovation of many sound designers. Sound reproduction and reinforcement in the theatre is now a highly sophisticated process; an art form waiting in the wings for its own recognition. As an example, Partridge identifies the accomplishments of British Sound Designer Martin Levant, who is credited with having “moved the lavaliere microphones from the performer’s chest to their heads, pioneered the use of Tannoy speakers, and introduced the still popular A/B system for vocals.”\textsuperscript{192}

On a dramaturgical level, sound design languishes in not yet having identified a similar revitalizing catalyst. Is it possible for the dramaturgy of sound design to be reinvigorated in a similar way to which digital music audio manipulation has redefined the sonic possibilities of sound creation? British-born Sound Designer, Jonathon Deans, observes, “[all of us] get used to listening to what we expect as opposed to listening beyond that…listening

\textsuperscript{192} Partridge
to something as if you have never heard it before…with no expectations."\(^{193}\)

Dean’s statement highlights the need for auditory aura to be aligned with the semiotic configurations and intentions of the drama.

The problem is twofold:

1. Defining a response system (System Model) that is consistent to the dramatic semiotic intention

And

2. Building an environment into which sound design ideas can be both iterated and mediated.

There is, nonetheless, an emerging indication of a shift in paradigm in the importance of sound design as a central dramaturgical construct with hybrid musical theatre/circus works of companies, such as Cirque du Soleil.\(^{194}\)

In Australia, similarly, developments in a “new style of visual and physical music theatre - often in the service of fragmented non-linear approaches to narrative,"\(^{195}\) are being influenced by the work of directors such as Douglas Horton and Barrie Kosky; and composers such as Martin Wesley-Smith, Martin Friedel, David Chesworth and Brenton Broadstock.\(^{196}\) New ways of thinking and creating theatre with music have emerged side by side for these

\(^{193}\) Partridge

\(^{194}\) KÀ, the new production by Cirque du Soleil, which opened on November 26, 2004 at the MGM Grand in Las Vegas, is a good example. The show, designed to be in a large space on varying movable levels, provides the audience with a completely different perspective and, often, unconventional experience of the artists and the overall performance. It may be construed to be musical theatre (in a conventional sense) as it has a through storyline. The music to the show, composed by René Dupéré, is film-like in quality with multi-layered themes and textures. Part of the music is pre-recorded (drums, percussion loops and a fifty-voice choir) supported by a live ensemble, comprised of two keyboards, guitar, drums, percussion, cello, hammered dulcimer and piano-accordion. For further information see: http://www.ka.com.


\(^{196}\) Jenkins and Linz 9.
composers with the advent of new technology composition software and hardware.

The musical theatre works of the aforementioned Australian composers reflect the manner in which compositional strategies have been influenced by an advocacy for the use of computers at the performance level. Robert Rowe speculates that this generic influence has been significant in two aspects - the manipulation of timbre and “the computer’s ability to implement algorithmic models for generating musical material.” Also, with the advent of high-speed digital signal processing (DSP) algorithms and increasingly faster computational speeds, the potential for real-time interactive performance systems able to recognize and respond to performance behaviours, have finally become a reality. Max/MSP is one such system.

As a prototype, The MaxStage provides only a point of departure for future discussion and research on collaborative sound design. Substantially more research and re-coding of the current MaxStage prototype (utilizing either the Java or Csound languages, and coded by a professional computer programmer) would be required before such an application had any potential practical benefit. One of the main limitations of The MaxStage prototype is that it does not take into account the inherent and very real problems of acoustic diffusion, reflection and delay in audio reproduction. Similarly, it cannot model sound design in any multi-speaker format (for example, in 5.1 surround sound).

New generation high-speed computers in tandem with increasingly sophisticated real-time music /sound design software are changing the nature of human-computer interactive possibilities. Recognizing the importance of the dramaturgical elements of sound design presents opportunities to extend the boundaries of this art form in Musical theatre.

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SOFTWARE
